

COMPUTATION OF THEMATIC FEATURES IN DEVERBAL NOUNS: PROBING THE EFFECT OF THE VERBAL ROOT*

Christina Manouilidou
University of Ottawa

1. Introduction

Research on the Mental Lexicon seeks to better understand the nature of mental representations and how they are accessed. On-line visual word recognition is the most frequently used technique in this type of research. As word recognition is assumed to involve successful accessing of a word's lexical entry in the mental lexicon, such studies can shed light on which aspects of a lexical representation are accessed and exploited either for recognition of a word or for constructing a higher-level representation. They can also determine at what point in time each lexical feature is processed.

Previous psycholinguistic research has identified a number of linguistic features that seem to play a role in visual word recognition. For instance, there is evidence that *complex morphological structure* influences lexical access, since complex words have to be decomposed into their constituents, especially if they are of low frequency (Chialant & Caramazza, 1995; Schreuder & Baayen, 1995). *Lexical category* also appears to affect lexical access. Different recognition patterns have been observed for verbs and nouns in a variety of experimental tasks and conditions (Pulvermuller et al., 1999; Mauner & Koenig, 1999; Friederici & Frisch, 2000). The dissociation between nouns and verbs is generally attributed to the internal complexity of verbs, which increases processing load, and more specifically to their argument structure properties or their *thematic features* (TFs), which are thought to be accessed at the early stages of word recognition (Joanette & Brownell, 1990).

Given the apparent effect on processing of TFs of verbs, we wondered whether TFs would also influence lexical access of deverbal word formations such as *driver*, *starvation*, *comprehensible*. Compared to other derived nouns e.g. *baggage*, *jealousy*, deverbal nouns demonstrate argument structure properties which are believed to originate from their verbal roots. It is not known whether these TFs are prominent enough to increase processing load for deverbal nouns without being overshadowed by complex morphological structure. Results of an earlier study (Manouilidou et al., submitted) suggest that the processing of TFs in deverbal adjectives might interact with the lexical access route. Namely, TFs appear to influence lexical access only when the deverbal word formation is accessed after decomposition. This possibility is further investigated in the present study. Before launching into a description of the study, I will briefly present some theoretical assumptions regarding deverbal word formation.

* The research reported here was supported by the MCRI grant from the Social Sciences and Humanities Research Council of Canada (#412-2001-1009) awarded to Gary Libben, Gonia Jarema, Eva Kehayia, Bruce Derwing, and Lori Buchanan. Thanks to Eta Schneiderman for useful comments.

2. Deverbal Word Formation

As with verbs, deverbal nominals (DVNs) have argument structure (AS) properties. For instance, in (1a) the NP the *enemy* has the thematic role of the agent while the NP the *city* has the thematic role of the theme. The same relationship between these two NPs is also found in (1b), where the verb has been replaced by the DVN *destruction*.

- (1) a. The enemy *destroyed* the city.
 b. The enemy's *destruction* of the city.

Examples like those in (1) show that nominals *can* take complements, which can be realized as arguments. The basic assumption behind every theoretical approach to DVNs is that the AS properties of these nominals must originate from the verb that is implicated in their derivation. Some syntactic approaches assume that there is a VP node in the nominal which is syntactically active (e.g. Borer, 1993) while others posit an event structure representation (e.g. Grimshaw, 1990; Alexiadou, 2001) in terms of functional layers that regulates the presence of AS of certain nominals. In contrast, lexical approaches postulate that AS becomes part of the lexical entry of a noun through either inheritance or percolation of the *verb* AS to the nominal (Hoekstra, 1986; Lieber, 1990). Baker and Bobaljik (2002) describe these percolation mechanisms in detail, by using their representational tools of Argument Binding¹, Substitution Linking² and Node Labelling Convention³. Figure 1 illustrates the derivation of the noun *teacher* within Baker & Bobaljik's system.

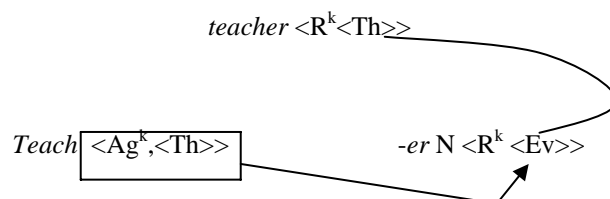


Figure 1: Derivation of *-er* nominal

The AS of the noun *teacher* consists of the external R argument, common for every noun, and a Theme internal argument. The verb *teach* takes an Agent external argument and a Theme internal argument. The suffix *-er* creates nouns and has a typical noun argument structure $\langle \text{R} \text{Ev} \rangle$. The R argument is also understood as being the same as the Agent of the verb root. This is called

¹ A designated argument of the head may *bind* a designated argument of the nonhead as required by the lexical entry. When this happens, no distinct phrase will express the bound argument, and it will be understood that the same item fulfills both argument roles (Baker & Bobaljik, 2002 : AS-39).

² The term *substitution linking* indicates that the argument structure of the non-head of a word can replace one argument of the head (Baker & Bobaljik, 2002: AS-31).

³ The properties of an affix take precedence over the properties of a root in determining the properties of a derived word. (Baker & Bobaljik, 2002: AS-15).

argument binding and can be represented by putting the same subscript on the binding argument and the bound argument. In *-er* suffixation, the <Event> argument gets replaced by the argument structure of the verb via *substitution linking*. This is then passed on to the nominal via another mechanism called *node labeling convention*.

Therefore, we can assume that the TFs of the verb are passed on to deverbal nominals via derivational mechanisms specific to each derivational suffix. Thus, while the source of the TFs in DVNs appears to be the verbal root, it is the actual combination of the verb and suffix that results in the particular TFs of a deverbal word formation.

3. Previous psycholinguistic results

Given that the internal complexity of verbs results in higher processing costs compared to nouns, and following a percolation model for the formation of DVNs which assumes this verbal complexity is inherited by deverbal word formations, one would wonder whether TFs play a prominent role in the processing of deverbal word formations.

The role of TFs in the lexical access of deverbal word formations was examined in a series of experiments using stimuli from Modern Greek (MG). The first study (Manouilidou, 2006) showed that the processing of TFs constitutes an essential step in lexical access of deverbal pseudo-words, since words with thematic violations yielded distinct reaction times compared to three other types of pseudo-words. Two subsequent studies focused on detecting whether TFs play an essential part in accessing existing words, more specifically DVNs (Manouilidou et al., 2004) and deverbal adjectives (DVAdjs) (Manouilidou et al., submitted).

While Manouilidou et al. (2004), which dealt with DVNs, showed that the number of arguments a DVN can take does not influence lexical access, Manouilidou et al. (submitted), which focused on DVAdjs, had a more intriguing outcome. In this study, DVAdjs (e.g. *katanoisimos* 'comprehensible', *perioristikos* 'restrictive') were compared to denominal adjectives (DNAdjs) (e.g. *mallinos* 'woollen') in an on-line experiment probing the effect of TFs in visual word recognition. The processing of TFs was detected only in those adjectives with the suffixes *-simos/-menos* (e.g. *skepasmenos* 'covered', *katanoisimos* 'comprehensible'). These two groups of adjectives were the single cases where the DVAdjs were accessed after decomposition into their constituents. We interpreted this as an indication of the crucial role of the **verbal root** in the lexical access of DVAdjs. In other words, it seemed highly likely that viewing the verbal root, which is the source of TFs for the DVAdj, triggers the processing of TFs in DVAdjs. The fact that this assumption is compatible both with syntactic approaches to nominalization as well as with the theories of inheritance of TFs from the verb made it doubly attractive. However, these are not sufficient reasons to reject a priori the possibility that processing of TFs of DVAdjs results from other factors such as a specific interaction of the verbal root and the **suffix**, which is also activated in case of decomposition. Only further research into the effects of decomposition and the role of the verbal root will reveal which factors determine the processing of TFs of DVNs.

4. The present study

Motivated by Manouilidou et al.'s finding that TFs may be accessed when the DVAdjs are decomposed, the present study further investigates the role of the verbal root in the activation of TFs of DVNs. The study compares on-line lexical access times for three groups of low frequency nouns that differ with respect to their structural complexity and TFs. The three groups are DVNs, such as *syntiritis* 'maintainer', denominal nouns (DNNs), such as *sfouggaras* 'sponge-diver' and non-derived nouns (NDNs), such as *adartis* 'partisan'. Our reasoning was as follows: In order to make the subjects decompose the stimuli during lexical access, we needed to use low frequency items. A comparison of derived nouns with NDNs would reveal whether or not decomposition actually occurred. We could then compare the decomposed DVNs to the decomposed DNNs. If longer RTs were observed for the DVNs, this could be attributed to the presence of their TFs. Thus our research question is the following: does decomposition and the consequently viewing of the verbal root facilitate accessing the TFs of DVNs?

4.1. Hypotheses

Our hypotheses are based on two working assumptions. The first is that the low frequency of the stimuli will cause them to be accessed after decomposition. As decomposition is at least partially responsible for longer RTs observed during the processing of complex forms, Hypothesis 1 states that we expect derived forms (DVNs and DNNs) to yield longer processing times than non-derived forms (NDNs).

Our second assumption is that the lexical entry of a DVN is specified for TFs inherited from the verbal root through various operations taking place during derivation. As decomposition will allow the verbal root of a DVN to be viewed, Hypothesis 2 states that TFs will be activated and this will be reflected in longer RTs for DVNs than DNNs.

4.2 Stimulus material

Stimuli included three sets of MG nouns matched for frequency, length and number of syllables: DVNs, DNNs and NDNs. The characteristics of each group of derived adjectives are described in the following paragraphs.

4.2.1 Deverbal Nouns (DVNs)

Three categories of DVNs were employed in the study, with 16 items in each. Each category is formed with a different suffix that demonstrates distinct sentential properties and TFs.

1. **DVNs-*tis***. Formed by adding the suffix *-tis* (the semantic equivalent of English *-er*) to a strictly transitive verb. The suffix *-tis* creates subject nominalizations, which refer to animate entities, e.g. *katakto* > *kakti-tis* 'to conquer' > 'conqueror'. As they do not permit manner adverbials (example 2a), cannot bear aspectual modification (example 2b) and do not take *by*-phrases in a

sentential context (example 2c), we could say that *-tis* nominals demonstrate a diminished verbal character.

- (2) a. *O katha ristic tou ktiriou *prosektika.*
 the cleaner theGEN buildingGEN carefully
 ‘the cleaner of the building carefully’
- b. *O katharistic tou ktiriou *epi ena mina.*
 the cleaner theGEN buildingGEN for a month
 ‘the cleaner of the building for a month’ (Alexiadou, 2001: 129)
- c. *O katharistic tou ktiriou *apo to Gianni*
 The cleaner theGEN building by the Jiannis
 ‘the cleaner of the building by Jiannis’

2. **DVNs-*si***. Formed by adding the suffix *-si* (the semantic equivalent of English *-ion/-ation*) to a strictly transitive verb. They refer to process/result nominalizations, e.g. *diorthono* > *diortho-si* ‘to correct’ > ‘correction’. In a sentential context, they do not tolerate aspectual modification denoting repetition, as illustrated in (3).

- (3) **I syhni anatinaxi tis gefyras apo to strato*
 the frequent blowing theGEN bridgeGEN by the army
 ‘the frequent blowing up of the bridge by the army’

3. **DVNs-*ma/-simo***. Formed by adding the suffixes *-ma/-simo*⁴ (the semantic equivalent of English *-ing* as in nominal gerunds) to a transitive verb. They denote mainly acts and more rarely results, e.g. *ravo* > *raps-imo* ‘to sew’ > ‘sewing’. In a sentential context, they tolerate adjectival aspectual modification denoting repetition and *by*-phrases, as shown in (4).

- (4) *To syhno plysimo ton piaton apo to Gianni*
 the frequent washing theGEN dishesGEN by the Jiannis
 ‘the frequent washing of the dishes by Jiannis’

4.2.2 Comparison between DVNs in *-si* vs. DVNs in *-ma/-simo*

Although both *-si* and *-ma/-simo* nominals have similar semantic properties, they also demonstrate considerable differences when placed in context. For instance, *-si* nominals can occur without complements more easily than *-ma/-simo* nominals, as in example (5).

- (5) a. *prosthimo gia epikindyni odigi-si*

⁴ The forms *-ma* and *-simo* are allomorphic variations of the same suffix. The form *-ma* attaches to multisyllabic bases, such as *diorthono* ‘to correct’ > *diorthoma* ‘correction’, while *-simo* prefers monosyllabic bases, such as *dino* ‘give’ > *dosimo* ‘giving’ (Drachman & Malikouti-Drachman, 1995).

- | | | | |
|----|--------------------|-----------------------|-----------------|
| | fine | for dangerous | driving-si |
| b. | ? <i>prosthimo</i> | <i>gia epikindyno</i> | <i>odigi-ma</i> |
| | fine | for dangerous | driving-ma |

Also, whenever there are pairs formed by the same verbal root and either *-si* and *-ma/-simo*, the *-ma/-simo* nominals denote more specific activities (as in 6a, 7a), while the *-si* nominals denote figurative and abstract notions (as in 6b, 7b). In contrast, *-ma/-simo* nominals would not be used figuratively.

- (6) a. *To kap-simo/*I kaf-si* *tou horiou* *apo* *tous*
 The burning-SIMO/*burning-SI theGEN villageGEN by the
Germanous
 Germans
 ‘The burning of the village by the Germans’
- b. *o organismos tou* *kanei kales kaf-seis*
 The organism his does good combustions
 ‘he has a good metabolism’
- (7) a. *To ply-simo/*I ply-si* *ton rouhon/piaton/dontion*
 The washing-SIMO/*washing-SI theGEN
 clothes/dishes/teethGEN
 ‘the washing of clothes/dishes/teeth’
- b. *Ply-si/*ply-simo* *stomahou/egkefalou*
 Washing-SI/*washing-SIMO stomach/brainGEN
 ‘brain washing, stomach washing/pumping’

Finally, as shown in (8), only the *-ma/-simo* nominals are compatible with modifiers such as *for an hour* (Alexiadou, 2001: 52-53).

- (8) a. *I diortho-si* *ton grapton* *se5 lepta/*ja 1 ora*
 The correction theGEN papersGEN in 5 minutes/for an hour
 ‘the correction of the papers in five minutes/for an hour.’
- b. *To diortho-ma* *ton rouhon* *se 5 lepta/ja 1 ora*
 The correcting theGEN clothesGEN in 5 minutes/for an hour
 ‘the mending of the clothes in five minutes/for an hour’

There are two important issues to keep in mind with respect to the above descriptions. The first is that the three groups of DVNs demonstrate diverse sentential and AS properties. For instance, those formed with *-tis* are the least ‘verb-like’, since they refer to animate entities and they do not accept modifications which typically occur with verbs. The *-si* nominals retain more verbal properties than DVNs-*tis*, but not as many as the *-ma/-simo* ones. The second point is that these differences result from the particular interaction of each verbal base with the individual suffixes involved in their derivation into nominals. The three types of DVNs described above are presumably formed in

an identical way, following the specifications of deverbal word formation. However, the fact that the same derivational operations result in DVNs with very distinct properties can only be attributed to the special contribution of each suffix. It remains to be seen whether these distinct properties differentially affect lexical access.

4.2.3 Denominal Nouns (DNNs)

The study comprises three groups of DNNs, with 16 items in each group. Unlike the DVNs, the DNNs lack TFs:

1. **DNNs-*as***. Formed from various nouns with the suffix *-as*, these DNNs serve as controls for *-tis* nominals and denote occupation or profession, e.g. *sfougari* > *sfouggar-as* ‘sponge’ > ‘sponge diver’.
2. **DNNs-*ia***. Formed from various nouns plus the suffix *-ia*, these DNNs serve as controls for *-si* nominals and denote qualities associated with the base noun, e.g. *zitianos* > *zitiania* ‘beggar’ > ‘beggary’.
3. **DNNs-*adiko***. Formed from various nouns plus the suffix *-adiko*, these DNNs serve as controls for *-ma/-simo* nominals and denote the place associated with the base noun, e.g. *psaras* > *psaradiko* ‘fisherman’ > ‘fishery’.

4.2.4 Non-derived Nouns (NDNs)

The stimulus set also comprised 48 NDNs that were matched for frequency, length, and number of syllables with the actual experimental stimuli. There were three groups of 16 NDNs, each serving as controls for a group of derived nouns. Within each non-derived group, attention was paid to matching the gender of their controls. For example, NDN: *andartis* ‘partisan’ was matched with DVN *kolymvitis* ‘swimmer’.

4.2.5 Fillers and Non words

The stimulus set also included filler word targets to distract participants from the purpose of the experiment. The 44 filler words consisted of various types of non-derived verbs. The 138 non-words in the list were obtained by replacing one or two letters of a real MG word in accordance with the phonotactic constraints of the language. The presence of non-words allowed participants to legitimately reject some of the stimuli as not being words in MG.

4.3 Methodology: on-line experiment

Data were gathered via an on-line, visual lexical decision task. Letter strings were presented to the participants, who had to indicate whether or not they constituted MG words. Both RTs in milliseconds and the number of errors were recorded. The program Psyscope 1.2.5 for Power Macintosh was used to present the stimuli and record responses.

4.3.1 Procedure and Participants

Stimuli were presented in a standard lowercase Greek typeface. Participants first saw a mask comprising a series of pound signs (#####) in the center of the screen, matching the number of characters of the preceding stimulus. The mask was presented for 200ms and was followed by a pause of 150 ms. The target appeared immediately after the pause. The interstimulus interval was set at 200ms. Stimuli were presented in blocks of 80. The actual test was preceded by a practice session comprising 10 items and a pretest comprising 10 trial items.

Twenty-four (24) native speakers of MG participated in the study. All were undergraduate and graduate students at Aristotle University of Thessaloniki.

4.3.2 Scoring and analyses

The dependent measure was lexical decision latency reported as RTs in milliseconds. In all analyses, separate ANOVAs were conducted, treating items as independent variables. Additionally, paired t-tests were also conducted when licensed as necessary. All reported RTs represent a mean of subject responses. Prior to the analysis, erroneous responses were removed, resulting in a loss of less than 3% of observations. Responses exceeding 1500ms were considered to be 'off-line' and were removed as well. Outliers (response times below and above two standard deviations from the mean) were also removed from the dataset. This resulted in a by subject loss of data varying from 2 to 7%.

4.4 Results

Table 1 demonstrates RTs and standard deviations (SD) for each group of stimuli. One-way ANOVA revealed an overall effect of category both by subject [$F(1, 23) = 4.80, p < .0001$] and by item [$F(2, 101) = 3.654, p = 0.0294$], while pairwise comparisons showed a significant difference between the derived forms and the non derived ones, DNNs vs. NDNs ($p=0.0316$), DVNs vs. NDNs ($p=0.0131$). However, no difference was observed between DVNs and DNNs ($p=0.9064$).

Table 1
Mean RTs (SD) in Milliseconds by Stimulus Type

Types of stimuli	RTs in ms + (SD)
DVNs	714 (62)
DNNs	713 (41)
NDNs	688 (44)

Thus Hypothesis 1, which predicted that derived forms (DVNs and DNNs) would yield longer RTs than NDNs, is supported. This further indicates that decomposition and consequently, activation of the verbal root, did occur for derived nominals. However, the lack of any difference between DVNs and DNNs shows that, while the verbal root was activated during lexical access, this

activation did not influence the processing of TFs. Therefore, Hypothesis 2 is apparently not supported.

On the basis of specific properties associated with DVNs formed with different suffixes described in 4.2.2, we carried out a more detailed analysis which intended to reveal any concomitant variation in processing across DVNs grouped by type. The analysis looked at how the properties of types of DVNs may have interacted with the processing or lack thereof of TFs. Hence, instead of grouping all the DVNs, all the DNNs and the NDNs, each type was treated separately. The results are shown in Tables 2a and 2b.

Table 2a
Comparison of Each Deverbal Noun Group with its ND Controls

Deverbal Nouns	Non-derived Controls	p-values
DVNs- <i>ma/-simo</i> 754(34)	NDNs- <i>adiko</i> 688(45)	p = 0.0001
DVNs- <i>tis</i> 690(35)	NDNs- <i>as</i> 657(39)	p = 0.0578
DVNs- <i>si</i> 706(35)	NDNs- <i>ia</i> 709(66)	p = 0.9288 NS

Table 2b
Comparison of Each Denominal Noun Group with its ND Controls

Denominal Nouns	Non-derived Controls	p-values
DNNs- <i>adiko</i> 722(23)	NDNs- <i>adiko</i> 688(45)	p = 0.0237
DNNs- <i>as</i> 702(43)	NDNs- <i>as</i> 657(39)	p = 0.0315
DNNs- <i>ia</i> 713(25)	NDNs- <i>ia</i> 709(66)	p = 0.9288 NS

The results indicate that two groups of DVNs (DVNs-*ma/-simo*, DVNs-*tis*) differ significantly from their non-derived controls. However, this is not the case for DVNs-*si* group, which yielded similar RTs to their ND controls. A similar disparity occurred within DNNs. DNNs with *-adiko* and *-as* differ significantly from their non-derived controls, while DNNs with *-ia* do not. These results strongly suggest that DVNs-*si* and DNNs with *-ia* were not accessed through decomposition.

In the light of these new findings, Hypothesis 2 was re-examined via an additional analysis for which the DVNs and DNNs were divided into two groups, based on whether or not they differed in RT from their non-derived controls. Thus the DVNs-*ma/-simo* and DVNs-*tis* and their controls DNNs -*adiko*, DNNs -*as* were placed in the *decomposed* lexical access route category. DVNs-*si* and DNNs-*ia* were placed in the non-decomposed lexical access route category. Results of this analysis are shown in Table 3.

Table 3
Comparison of DVNs and DNNs, Grouped by Lexical Access Route.

Nouns	-decomposition
DVNs- <i>si</i> vs. DNNs - <i>ia</i>	→ p = 0.74 NS

Nouns	+decomposition
DVNs- <i>ma/-simo</i> vs. DNNs- <i>adiko</i>	p = 0.0383

DVNs- <i>tis</i> vs. DNNs- <i>as</i>	p = 0.4919 NS
--------------------------------------	---------------

The lack of difference between DVNs-*si* versus DVNs-*ia* is compatible with our prediction that only decomposition will trigger processing of TFs. Therefore, we can still maintain that decomposition may be a necessary prerequisite to the processing of TFs of DVNs, as originally hypothesized. However, if we focus on the decomposed group, we see that still there is no uniformity. The decomposed DVNs-*ma/-simo* differed significantly from their DN controls. We take this difference to reflect processing of TFs for DVNs-*ma/-simo*. Nevertheless, the effect of TFs was not detected for the DVNs-*tis*, since they did not differ significantly from their DN controls. This further suggests that the processing of TFs might be due to the specific properties of each nominal and not to the view of the verbal root. We are dealing with this issue in the following section.

6. Interpretation

Based on theoretical proposals such as the one by Baker and Bobaljik (2002) that the TFs of the verbal root are passed on to the deverbal nominals via the derivational suffix and taking into account previous psycholinguistic evidence which indicated that TFs of a DVN might be processed only when decomposition takes place, the aim of the present study was to determine to what extent the decomposition access route and the subsequent activation of the verbal root would result into the surfacing of TFs of a DVN through longer RTs. As we saw, two groups of DVNs were accessed after decomposition, those formed with the suffixes *-ma/-simo* and those formed with the suffix *-tis*. Nevertheless, only the DVNs-*ma/-simo* yielded longer RTs than their denominal controls. This difference was attributed to the processing of TFs. However, the lack of a significant difference in RTs between decomposed DVNs-*tis* and DNNs-*as* suggests that the presence of TFs does not appear to add to the processing load of DVNs-*tis*. Therefore, we cannot maintain that viewing the verbal root automatically triggers the processing of TFs. Instead, we consider decomposition to be a necessary but not a sufficient condition for the processing of TFs in DVNs.

We can perhaps explain the disparity in processing of TFs in decomposed DVNs by examining possible conditioning factors of the specific properties of each item type. In section 4.2.2 we saw that there are significant differences between the nominals formed with *-ma/-simo* and those formed with *-tis*. Namely, while DVNs *-tis* refer to an animate entity and do not show any ‘verb-like’ behavior, those formed with *-ma/-simo* are the prototypical process nouns, they are semantically eventful and they demonstrate ‘verb-like’ sentential properties. This line of thinking allows us to make a link with the results obtained by Manouilidou et al. (submitted) for the DVAdjs where the processing of TFs was only observed in those items formed with the suffixes *-simos/-menos* (see section 3). These suffixes form adjectival passives which by default have increased ‘verb-like’ properties compared to other descriptive adjectives. Therefore, with respect to our research question, it seems that the role of the verbal root in triggering the processing of TFs is not as prominent as

originally anticipated. Instead, it appears that it is the specific properties of a particular item which are responsible for the processing or not of its TFs. And these properties are determined by the suffix. For instance, although the DVNs *read-er*, *read-ing*, *read-able* are formed on the same base, they are very distinct from one another in every other respect. Their differences can only be attributed to the particular suffix used to derive each one.

This claim is still compatible with the role of decomposition. Namely, decomposition not only facilitates the activation of the verbal root but it equally facilitates the activation of the suffix. When the suffix is activated, all the specific properties of a word become visible. As these properties happen to indicate an increased 'verb-like' character, then TFs have a more prominent role and they are processed in the same way as in verbs. In fact, the surfacing of TFs in DVNs may depend more on the activation of the suffix than on the activation of the verbal root.

The results of the present study have further implications for the mental representation of DVNs and theories of deverbal word formation. The major finding of our research are that viewing the verbal root is not the sole determining factor in triggering the processing of TFs. Instead, this processing of TFs seems to depend on the verbal character of the particular nominal, which results from the properties of the suffix. Hence, the role of the suffix should not just be seen as transmitting the TFs of the verb to the DVN, but more importantly as determining the actual AS properties of the new word formation. Moreover, if TFs are processed only for those DVNs with increased verbal properties, then this further implies that TFs are not a defining characteristic for every DVN, but rather only for those with an increased eventful character. In addition, the fact that the parser may have to decompose a DVN into its constituents in order for the TFs to be accessed suggests a layered mental representation for DVNs in which their various properties exist at different levels and are not accessed at the same time during the recognition process. It remains to be seen whether such layering is unique to the processing of DVNs or whether it is a more general organizational attribute of the lexicon.

7. Conclusion

The present study examined the role of the verbal root in processing the TFs of a deverbal noun. The results of our experiment demonstrated that the processing of TFs in deverbal word formations does not depend on the view of the verbal root, but rather on the 'verb-like' properties of the stimuli. In this respect, the role of the suffix as determiner of these properties appears to be crucial. Similarly, decomposition during lexical access is still an important factor, since it makes the suffix transparent and it facilitates the surfacing of the internal properties of the word. Consequently, theories of deverbal word formation should take into account the determining role of the suffix. Finally, it seems that DVNs do not have a uniform mental representation. For those with increased 'verb-like' properties, TFs are an integral part of their representation and, consequently, are processed during word recognition in those cases where lexical access proceeds via decomposition. Therefore, we can maintain that TFs of verbs and TFs of DVNs do not have the same status in the mental

representation of these lexical items, with the latter appearing at a secondary level in a layered mental representation.

References

- Alexiadou, Artemis. 2001. *Functional Structure in Nominals: nominalization and ergativity*. Linguistik Aktuell/Linguistics Today, Amsterdam/Philadelphia: John Benjamins.
- Baker, Mark C., and Jonathan Bobaljik. 2002. Introduction to morphology. Ms. Rutgers and McGill University.
- Borer, Hagit. 1993. *Derived Nominals*, MS. University of Massachusetts, Amherst.
- Chialant, Doliana, and Alfonso Caramazza. 1995. Where is morphology and how it is processed? The case of Written Word Recognition. In *Morphological aspects of language processing*, ed. Laurie Beth Feldman, 55-76. Hillsdale, New Jersey: Lawrence Erlbaum Associates, Publishers.
- Friederici, Angela, and Stephan Frisch. 2000. Verb argument structure processing: the role of verb-specific and argument-specific information. *Journal of Memory and Language* 43:476-507.
- Grimshaw, Jane 1990. *Argument Structure*. Cambridge, MA: MIT Press.
- Hoekstra, Teun. 1986. Deverbalization and Inheritance. *Linguistics* 24:549-584.
- Joanette, Yves, and Hiram H. Brownell. 1990. *Discourse ability and brain damage: theoretical and empirical perspectives*. New York: Springer-Verlag.
- Lieber, Rochelle. 1990. *On the organization of the Lexicon*. New York, London: Garland.
- Maurer, Gail, and Jean-Pierre Koenig. 1999. Lexical encoding of event participant information. *Brain and Language* 68:178-184.
- Malikouti-Drachman, Angeliki & Gaberell Drachman. 1995. Prosodiaki Perixaraksi kai Theoria tou Veltistou: mia proti efarmogi sta ellinika [Prosodic Circumscription and Optimality Theory: A First Application in Greek]. *Studies in Greek Linguistics* 1994:186-198.
- Manouilidou, Christina. 2006. Thematic constraints in deverbal word formation. To appear in *Proceedings of the 7th International Conference on Greek Linguistics*. University of York, UK.
- Manouilidou, Christina, Eva Kehayia, and Eta Scheiderman. (submitted). Computation of thematic information in accessing deverbal adjectives. Submitted to CLO/OttawaWPL.
- Manouilidou, Christina, Eva, Keyahia, and Eta Schneiderman (2004). On the processing of Thematic Features of deverbal nouns. Presented at 11th International Morphology Meeting, Vienna, Austrian Academy.
- Pulvermuller, Friedemann, Bettina Mohr, and Hans Schleicher. 1999. Semantic or lexico-syntactic factors: What determines word-class specific activity in the human brain? *Neuroscience Letters* 275:81-84.
- Schreuder, Robert, and Harald H. Baayen 1995. Morphological aspects of language processing. In *Morphological aspects of language processing*, ed. Laurie Beth Feldman, 131-154. Hillsdale, NJ: Erlbaum.
- Selkirk, Elisabeth. O. 1982. *The syntax of Words*. Cambridge, MA: MIT press.
- Williams, Edwin. 1981. On the notions *Lexically related* and *Head of a Word*. *Linguistic Inquiry* 12:245-274.

