# Nouns and verbs as grammatical classes in the lexicon

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The present study addresses the issue of the distinction between nouns and verbs in the lexicon and investigates if and to what extent the grammatical properties of nouns and verbs play a role in organizing the lexical knowledge. Evidence from linguistics, cognitive psychology and cognitive neuropsychology of language is reviewed in order to support the conclusions that, among many other dimensions, nouns and verbs are represented as grammatical classes in speakers' lexical knowledge. Furthermore, the grammatical knowledge of the two classes of words plays the role of an organizational principle in the lexicon, and contributes to explain the organization and the format of words' representations as well as their possible neural and functional damages [*].

## *1. Introduction*

Two deeply debated questions in the sciences of language concern the problems of how the lexical knowledge is organized and whether or not the grammatical properties of different classes of words play a role in this organization. Research carried out in linguistics, cognitive psychology and neurosciences has tried to answer these questions, investigating whether and to what extent the lexical representations of words depend on their grammatical features. Most of the studies have mainly investigated the distinction between nouns and verbs in the lexicon. Linguistic research has traditionally discussed the criteria on which the noun/verb distinction is built on. Research in cognitive psychology and neurosciences has mostly investigated the function of nouns and verbs as distinct parts and organizational principles of our lexical knowledge. The two questions are closely related, but conceptually independent. In this paper we will try to use and compare some data drawn from the three mentioned levels of investigation, focusing on the contribution given by the grammatical information in the noun/verb distinction.

One of the principles that holds of almost all languages is that among their words they all have types that correspond at least roughly to the categories of nouns and verbs. However, the broadening of inquiries to a larger number of non Indo-European languages made it clear that nouns and verbs, respectively, do not always repre-

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sent the same linguistic objects in every language of the world and/or are not always separate objects (Sasse 2001).[1]

Even assuming NOUN and VERB as theoretical categories whose linguistic manifestation can be differently shaped in different languages, the noun/verb distinction has to be further specified: what is the nature of this distinction? Is it possible to enumerate the necessary and sufficient features that define a noun or a verb? Are these features hierarchically ordered? Although different positions are maintained about these topics, it seems that, according to different theoretical positions (Bybee 2000), lexical, semantic, syntactic, morphological and pragmatic factors may act differently in shaping the noun/verb distinction, but none of them can be excluded *a priori*.

If we turn to the available evidence from linguistic, psycholinguistic and neuropsychological data, that will be briefly reviewed in the next section, the distinction between nouns and verbs still emerges as a multi-faceted issue, that cannot be reduced to a single dimension of language processing or language description. Moreover, it emerges that the noun/verb distinction: a) may be referred to in a variety of domains: modality (oral/written), tasks (oral production, reading, writing, picture naming, and so on), and behaviors (production/comprehension), and b) is likely to be modulated according to the specific intersection of modalities, tasks and behaviors we consider.

## *2. Nouns and verbs: a brief review*

On cognitive bases, many experiment have investigated how nouns and verbs are processed and represented, providing consistent support for the noun/verb dissociation hypothesis, namely, the hypothesis that nouns and verbs are autonomously represented as grammatical classes in the lexicon. Studies from the field of neuropsychology have focused mainly on *output* mechanisms, for both spoken and written language (Rapp & Caramazza 1997). First of all, marked dissociations have been shown in the retrieval process of nouns and verbs in so-called agrammatic patients, with a relative impairment in verb retrieval as compared to noun retrieval (McCarthy & Warrington 1985; Miceli et al. 1988; Miceli et al. 1984; Zingeser & Berndt 1990). In these patients, deficits on verbs have been associated with the damage to the syntactic processing device - what appears to be, *prima facie*, a correct conclusion. Verbs are more intimately associated with sentence processing in speech production, since verbs' argument structure plays a central role in the assembly

of sentences, allocating lexical items to their appropriate slots within the syntactic frame. Thus, a dysfunction in the connections between syntactic processing and the lexicon would affect verbs much more than nouns.

Nevertheless, experimental observations on adults with selective disturbances of language have also shown double dissociations between the impairment of one grammatical class and the sparing of the other, in both comprehension and production tasks: in some cases, a selective impairment in verb processing has been shown (Caramazza & Hillis 1991; Daniele et al. 1994); in other cases, the opposite pattern – a selective deficit in noun processing – has been observed (Daniele et al. 1994; Zingeser & Berndt 1990). Interestingly, grammatical class effects are in some cases restricted to single modalities of output: for instance, some patients show a deficit in oral, but not in written production of verbs. In their study of patients HW and SJD Caramazza & Hillis (1991) found strong evidence in favor of the grammatical class deficit selectivity. The former patient showed a selective deficit for verbs in naming and oral reading but not in writing; the latter patient showed the same dissociation in written naming and spelling to dictation but not in speech. For the purposes of the present paper it is important to emphasize the modality-specific character of the deficits for two reasons. The first reason is that it seems to suggest that grammatical class information be represented in connection not only with word meaning, but also with word phonological and orthographic output representations. The second reason, (as we will explain more thoroughly in the next section), is that the modality-specific deficits seem to preclude an account of these deficits in terms of a damage to the semantic representations (Caramazza & Shapiro in press a).

When we turn to the neural localization of the lesions, we still find evidence for relevant dissociations: deficits in noun processing are often consequent to left temporal lobe lesions, while impairment in verb (and function word) processing are frequently associated with left frontal lobe lesions (Damasio & Tranel 1993; but see Perani et al. 1999). Damasio & Tranel (1993) make a specific assumption based on the three cases they report: following their explanation, nouns are represented in the left anterior and middle temporal regions, while verbs are represented in the left frontal region. More recently, on the basis of neuroimaging studies, two more specific hypotheses have been advanced: a) two distinct neural circuits subserve nominal and verbal morphosyntax: the first left fronto-temporal circuit would be associated with the processing of nouns; the second left fronto-pari-

etal circuit would be associated with the processing of verbs; b) the left prefrontal area is involved in processing words as grammatical objects (for instance, in carrying out morphological manipulations on verbs), independent of their semantic content (Caramazza & Shapiro in press b).

Evidence in favor of the functional distinction between nouns and verbs comes also from experimental studies on normal adults. These studies have focused mainly on *input* mechanisms, mainly for written language, and in a number of languages. A very concise summary of the major findings follows.

CHINESE: Hsu et al. (1998) investigated Chinese compounds and detected syntactic effects at the sublexical level during word recognition. In particular, the results showed that different combinations of nominal and verbal morphemes within a compound influence lexical access: participants recognized faster compounds resulting by a combination of two words of the same grammatical class.

ENGLISH: it has been found that nouns are processed better and faster than verbs in comprehension tasks (Spenney & Haynes 1989). In a lexical decision task, Sereno & Jongman (1997 Exp. 1) investigated the representation of inflectional morphology in the lexicon and found that nouns were responded to faster than verbs. According to the authors' interpretation, these results are explained by one aspect of the different distribution of inflected forms in nouns and verbs (the relative frequency of base forms compared with the other forms is higher for nouns than for verbs).

HEBREW: also in Hebrew, a language relying on a non-linear morphology, it was shown that verbs and nouns elicit different response behaviors when submitted to a morphological priming condition (Deutsch et al., 1998; Frost, Forster & Deutsch 1997). In the Hebrew nominal system, masked primes determine facilitation on targets when they share the same root, while in the verbal system facilitatory effects are obtained when masked primes share both the same root and the word pattern as the target word.[2]

SERBO-CROATIAN: Kostic & Katz (1987) found processing differences between nouns, adjectives, and verbs in a set of lexical decision experiments on inflected words: they found a processing advantage for the nominative case in both singular and plural nouns and a strong influence of inflected form frequency for adjectival and verbal processing. Their conclusion was that inflectional processing depends on the number of inflectional alternatives for each grammatical class.

All these results, from both normal participants and patients with acquired disturbances of language, suggest that the grammatical class

of a word affects nearly all aspects of word processing (word production, word recognition, word comprehension) both when words are processed in a sentential context and when they are processed outside the syntactic context of a sentence. Moreover, categorial effects are consistently found not only in morphologically rich languages like Hebrew and Serbo-Croatian, but also in such languages as English, with a very poor inflectional morphology, both nominal and verbal.

In spite of the massive experimental evidence supporting the representational distinction between nouns and verbs, the interpretation of such distinction is far from being uncontroversial, given that several sources of information and/or processing components could be responsible, in principle, for the differences found. Noun and verb processing could be different by virtue of semantic factors: nouns have, on average, a higher degree of concreteness and imageability than verbs (Chiarello et al. 1999); noun and verb concepts have a different balancing of sensory and functional features. Nouns and verbs could also differ for their argumental structures: the argumental structure may be more or less complex in verbs, but it is present only in some classes of non-prototypical nouns, e.g., deverbal nouns (see Collina et al. 2001; Kim & Thompson 2000). Moreover, morphosyntactic factors are another potential source of variation between verbs and nouns: verbs are more functionally tied to sentential processing than nouns. We will turn again to this issue later. For the moment we only observe that all the cited factors would make the same prediction relative to the direction of the experimental effects: verb processing should be more difficult (or more vulnerable) than noun processing. Nonetheless, the patient EBA, (Hillis & Caramazza 1995), shows the opposite pattern, namely a more marked impairment for nouns than verbs in spoken production. More to the point, some data on normal processing show that grammatical information for verbs is not only activated in the syntactic component of the linguistic system, but is also represented in the *output* lexicon (Laudanna et al. 2002a).

In linguistics nouns and verbs have been considered as the basic parts of speech. The distinction between nouns and verbs is in one sense so pervasive that it is difficult to indicate *a priori* which linguistic level pertains: lexicon, morphology, syntax, semantics, pragmatics, and so on. Because of the variety and the number of researches, here we will try to sketch the focal questions related to the noun/verb distinction rather than give a survey.

We can distinguish two different approaches as far as the noun/verb distinction is concerned, that we can roughly called the

theoretical approach and the typological approach. The two perspectives are not mutually exclusive, but they usually try to answer different questions. Theoretical linguistics considers nouns and verbs as explanatory tools and does not necessarily take position about the reality of nouns and verbs as linguistic objects. On the contrary, typological linguistics has investigated the linguistic reality of the distinction in a large number of languages. Therefore, theoretical linguistics focuses on the relevant criteria for the distinction and on its status within the theory of grammar (Croft 1991), while typological linguistics focuses on the variety of nouniness and verbiness exhibited by the different languages of the world (Sasse 2001). The results are not always comparable since the perspective refers to different levels of representation of the nouns/verbs distinction, and there are not many studies that discuss the theoretical implications of typological approach (Ramat 1999). Yet many typological researches could open new perspectives even for theoretical aims. The broadening of our knowledge on a wider number of languages makes clear that not only the noun/verb distinction can be shaped in many different ways, but it can also be based on different criteria. In other words, the nature of language can determine which criteria can be used: "while most languages furnish both morphological and syntactic criteria, in extreme isolating languages such as Vietnamese only syntactic criteria can be used" (Evans 2000: 708).

Another issue deeply debated in typological studies is the degree of categoriality that must be assigned to the noun/verb distinction (Ramat 1999). It is known that there are languages for which the distinction between nouns and verbs seems to be just a question of degree. In fact, there are words belonging to classes which share some features of both nouns and verbs, such as the *vouns* and *nerbs* in Murrinh-Patha, a Northern Australian language (Sasse 2001).

In spite of all the differences reported, what is particularly striking from our point of view is that both theoretical linguistics and typological linguistics refer to the same inventory of features as explanatory tools. As Sasse (2001: 506) points out: "the discussion of the noun/verb distinction has predominantly centered around the question of word classes being more or less distinct; the possibility of 'otherness' is seldom taken into account". This means that there is a substantial convergence on the fact that nouns and verbs are (or should be) classes of words which share semantic, syntactic, morphological and pragmatic features (Givón 2001).

Generally nouns are defined as the class of words referring to entities and verbs as the class of words referring to processes. This

kind of semantic definition (or one of its variants) is so well established in the linguistic tradition, that nearly any author quotes it (Langacker 1987; Givón 2001). The semantic difference is clearly related to the fact that nouns and verbs tend to assign different thematic roles to their arguments. There is a general agreement that semantic and syntactic properties are deeply related (Anderson 1997; Anward 2001). The semantic selection should determine the syntactic category, i.e. the connection between thematic roles and syntactic categories is strongly predictable (Chomsky 1986). As lexical categories, nouns and verbs have different syntactic properties: it is the verb that assigns the case to any phonetically realized Noun Phrase (Chomsky 1981). This means that nouns normally have no argumental structure, while verbs necessary have it.

Both semantic and syntactic properties are related to discourse and pragmatic functions: nouns are typically subjects and themes, while verbs are typically predicates and comments (Andrews 1985). According to some authors, informational structure has a particular relevance in distinguish nouns because of its independence from syntactic and morphological factors (Hopper and Thompson 1984; 1985).

As a consequence of their different syntactic role, nouns and verbs differ also as far as morphological properties are concerned. These distinctions involve several morphological features, but one of the most relevant seems to concern the nature of inflection. According to Booij (1996), two types of inflections should be distinguished, inherent and contextual inflection. The former is not required by syntactic context, i.e. it is not specifically related to the role the lexical item holds in the sentence. On the contrary, the latter is totally depending on the syntactic role the lexical item holds in the sentence. Although nouns and verbs can exhibit both inherent and contextual inflection, inherent inflection seems to have a heavier weight in nominal morphology and contextual inflection a heavier weight in verbal morphology.

In some languages nouns and verbs have different phonological features, such as stress pattern in English. Cross-linguistic studies on intonation claim that nouns and verbs occupy systematic prosodic positions as far as the pitch accent is concerned (Kelly 1992). Since accent distribution depends on focus distribution, investigations on nouns and verbs location in prosodic patterns is strictly associated to their function in the informational structure of the utterance (Ladd 1996).

What is important to point out here is that, as a result of the described underlying differences at both cognitive and linguistic

level, nouns and verbs differ from each other also distributionally, at least in two senses. Firstly, in many languages the frequency of nominal and verbal stems is distributed over quantitatively different sets of word patterns. For instance, in Italian nouns result from the combination of a stem with a vowel suffix, and the number of inflected forms for a noun in most of the cases is two, one for the singular form and the other for the plural. On the other hand, verbs result from the combination of a stem with a suffix whose length may vary to a large extent, and the number of inflectional endings that a verb stem may combine with is about fifty. The different richness of inflectional paradigms could favor different modalities of processing.

Secondly, the distributions of nouns and verbs differ because of their diverging patterns of occurrence in oral vs. written texts. Nouns and verbs hold different roles even in the construction of different types of texts. In studies comparing spoken and written texts in various languages constant diverging patterns of occurrence of nouns and verbs have been found. Two variables seem to be relevant in determining the frequency of nouns and verbs in a text: the amount of dialogue and the amount of planning (Biber 1995; Biber et al. 1999; Blanche-Benveniste 2001; Voghera in press). In general, nouns are generally more frequent in monologues and planned texts, while verbs are more frequent in dialogues and spontaneous texts. Since spoken texts are basically spontaneous dialogues and written texts are basically planned monologues, nouns and verbs have a different relevance in speaking and writing. Thus, the underlying differences between nouns and verbs are reflected (at least in some languages) in diverging patterns of nominal vs. verbal inputs which the listener/reader is exposed to and, hence to putative differences in their resulting representations.

### *3. Nouns and verbs as lexical classes*

In spite of the multidimensionality of the distinction between nouns and verbs, we do not hold a completely interactionist view. We will discuss one specific aspects of the noun/verb distinction, trying to disentangle this aspect from the many others at our disposal: the representation of nouns and verbs as grammatical classes in the lexicon. In other terms, we assume that grammatical knowledge is represented in the lexicon and plays the role of an organizational principle. The basic grammatical knowledge relates to the words' syntactic category, or grammatical class, and its major function is to provide the

means by which words can be combined in syntactic frames (Caramazza & Shapiro in press a).

Among the other issues, the categoriality of the distinction between nouns and verbs has been often addressed: it is implicitly taken for granted by some researchers and rejected by others. Given that linguistic, psycholinguistic and neuropsychological data do not always provide unambiguous answers, the representational distinction between nouns and verbs as grammatical classes is far from being uncontroversial, given that it can be confounded with several other sources of information and/or processing components: semantic factors, argumental structure, morphosyntactic factors, and so on.

On the basis of this consideration, Bates et al. (1991) have distinguished three classes of explanations that can be given for the noun-verb distinction in lexical knowledge:

a SYNTACTIC explanation, according to which nouns and verbs encompass different functions in assembling sentences;

a LEXICAL-GRAMMATICAL explanation, which suggests that the main divergence between nouns and verbs is in their different status as grammatical classes;

a SEMANTIC-CONCEPTUAL explanation, which focuses on the differences between nouns and verbs in terms of those semantic features (like concreteness and imageability) that are associated to lexical meaning.[3]

In what follows, the goal of this paper will not be to dispute that the distinction or the dissociation between nouns and verbs may be sometimes interpreted as a consequence of syntactic or semantic factors. Rather, we would like to show that some sets of experimental data are to be explained as the effect of differences genuinely due to grammatical class, with limited possibility of appeal to syntactic or semantic factors.[4]

In considering the "syntactic" hypothesis, we have already observed that the relative difficulty on verbs as opposed to nouns displayed by agrammatic patients has often been causally related to the impairment of the mechanisms of syntactic processing. However, Caramazza & Hillis (1991) reported the case of two patients who had a specific impairment in verb production, although they could speak fluently. Berndt et al. (1997) described the case of a patient who demonstrated problems in producing and comprehending sentences, but who produced verbs better than nouns in picture naming. More recently, Shapiro & Caramazza (in press b) reported the case of a patient who was impaired in producing verbs in a picture naming task, even though she was able to process verbs as syntactic object in

tasks that required the utilization of the morphosyntactic knowledge of verbs. Some data on normal processing of verbs also show that the activation of grammatical features of verbs takes place even outside a syntactic context (Laudanna et al. 2002 a). Hence, we can conclude that, although verbs are relevant for syntactic processing and some types of verb's impairment develop from a more general impairment to syntactic processing mechanisms, the association between syntactic processing and grammatical processing of verbs is neither necessary, nor universal.

Among those who opt exclusively for one of the three explanations outlined by Bates et al. (1991), the most common opinion is that all noun/verb differences depend on semantic grounds. In this case, the hypothesis made about the categorial representation of nouns and verbs is that it represents nothing but the epiphenomenon of a basic semantic distinction. For instance, it has been argued that the distinction is so universally grounded in the human cognition that it emerges even in absence of any linguistic input. Goldin-Meadow et al. (1994) reported the case of a deaf child who, even being not exposed to sign language, invented a self-styled gesture system in which gestures for nouns were neatly distinct from gestures for verbs under many respects. On theoretical grounds, Pinker (1984) states that the child uses innate knowledge of semantics-to-syntax correspondences (e.g., words referring to objects tend to be nouns, while words referring to actions tend to be verbs) in order to find out the basic syntactic rules and categories in the input. In the neuropsychological literature, it has been claimed that nouns are, on average, more imageable and richer in their semantic features than verbs, with the consequence that they are less likely to undergo an impairment (Bird et al. 2000). Furthermore, it has been found that argument complexity is a source of difficulties for some patients (Kim & Thompson 2000), even when grammatical class and imageability are controlled (Collina et al. 2001).

Under all these views, one could be tempted to argue that in the description of human languages, as well as in the explanation of linguistic representations in the mind/brain, the distinction between nouns and verbs, if not reduced to, might be sufficiently motivated on the basis of deep cognitive and semantic universals: e.g., the oppositions between objects and actions, or between entities and processes, or the fact that nouns tend to encode sensory features while verbs tend to include non-sensory features. If this hypothesis would be entertained, verb deficits could always be classified as the consequence of a general damage to the semantic system.

Thus, the first question to be answered is whether lexical-grammatical knowledge has a functional and neuroanatomical basis separate from other aspects of a word's representation: in order to solve this problem, selective deficits in the oral production of verbs relative to names have been reported in the neuropsychological literature, and those deficits have been generally associated to frontal lesions or to other neurological damages. However, the origin of these disturbs is still not completely clear: in other terms, it is not clear whether they originate from the way in which the grammatical classes are organized in the brain or they derive from the selective damage of the neural representation of actions vs. objects. We argue that the available experimental results (patterns of lexical processing deficits, but also some reaction time data) force us to postulate that grammatical class information is an organizing principle of the representation of lexical knowledge in the mind/brain.

The first piece of evidence in favor of the hypothesis that the grammatical class information is represented in the lexicon derives from the neuropsychological literature. While in some cases noun/verb dissociations are the consequence of damage to the semantic features that are more prototypical of either nouns or verbs, in a number of other reports patients are described who display a marked dissociation between nouns and verbs, even though their semantic knowledge is undamaged. The most representative cases are those in which grammatical class effects are restricted to single modalities of output: in other terms, patients are impaired just in one category (nouns or verbs) and only in one modality (oral or written) (Caramazza & Hillis 1991; Rapp & Caramazza 1998). If the performance of these patients was attributable to a deficit in their semantic knowledge, the impairment should involve both output modalities. These studies not only support the view that grammatical class is a significant aspect of the lexical knowledge, but also show that it is relevant in simple tasks like producing, reading or writing single words, performed without the involvement of any context.

Recently (Shapiro & Caramazza in press b), it has been reported the case of an aphasic patient (RC) who showed greater difficulties in the production of grammatical forms of words and pseudo-words used like verbs (*he judges*, *he wugs*) than in the production of the same words and pseudo-words used like names (*the judges*, *the wugs*). In this case, the use of homonyms also ruled out the possibility that the dissociation was due to formal factors of orthographic or phonological complexity. This performance constitutes an extremely clear demonstration that the grammatical aspects of the processing of verbs can

be selectively compromised as a result of a cerebral damage. The comparison of the behavioural and neurological profile of RC with the profile of an other patient (JR, Shapiro et al. 2000) who displays analogous difficulties with the names, supports the hypothesis that the grammatical processing of names and verbs involves distinct neural systems in the frontal lobe. This conclusion was further confirmed by neuroimaging results from fMRI.

Summing up, what makes the "semantic" hypothesis inadequate as an ubiquitous way of explaining dissociations of grammatical class is mainly the performance of patients showing selective disturbances in processing nouns or verbs either in speaking or in writing, and either in spoken or in written comprehension. Furthermore, it should be taken into account that there are also some patients who, at the same time, show greater difficulty in producing words of one grammatical class in speaking and words of the other class in writing. If the difficulties in producing one class of words were the result of a damage to the semantic system, they could not be visible selectively in only one modality of output, but would affect in the same manner both speaking and writing, or both oral and written comprehension.

Finally, studies based on the technique of rTMS (repetitive Transcranial Magnetic Stimulation) have shown that one area of the left hemisphere, the prefrontal area, is involved in processing grammatical properties of words (in particular verbs), independent of their semantic content.

Arguments in favor of the view that grammatical class is a critical feature of lexical representation come also from the cognitive psychology of language. Here we will describe the results of an experiment conducted on Italian verbs and nouns (Laudanna, Voghera & Gazzellini 2002 b). These results suggest that lexical access mechanisms are sensitive to grammatical class information, even when semantic or syntactic dimension are not sufficient to explain the human performance. As in the analysis of the acquired disturbances of language, in principle, experimental noun-verb differences might also be ascribed to semantic, syntactic, or orthographic/phonological factors: one of the goals of the research of Laudanna et al. (2002 b) was to circumscribe the analysis of differences between nouns and verbs to their representation as grammatical classes in the input mental lexicon. More specifically, we addressed the issue of the representation and processing of nouns and verbs with reference to the task of recognizing inflected words, by testing the hypothesis of a grammatical class distinction in the orthographic input lexicon. We employed experimental conditions

and stimuli which should allow to disentangle grammatical/morphological information from semantic, syntactic and orthographic/phonological information. We exploited the inhibitory priming effect between stem homographs reported by Laudanna et al. (1989; 1992). Stem homographs are unambiguous word forms with stems that are orthographically and phonologically identical but semantically and grammatically different (e.g., *colpire* "to hit" whose stem is *colp*-, V, 3rd Conj., vs. *colpa* "fault" whose stem is *colp*-, N, Fem.). When a word form containing a homographic stem like *colpa* is primed by a word form like *colpire* – a morphologically unrelated word with a homographic stem – a robust inhibitory effect on recognition, when compared with both an unrelated prime condition and an orthographically similar prime condition, is found.

The inhibitory effect on stem homographs has been interpreted as the result of the activation of the stem entry (*colp*-, V, 3rd Conj.) for *colpire*, which interferes with the subsequent attempt to activate the orthographically identical stem entry (*colp*-, N, Fem.) for *colpa*. This interference was hypothesized to reflect the lexical system's response to the presence of two entries with the same form. Since the goal of the access process is the activation of only one entry matching the input stimulus, if the lexicon has two grammatically distinct entries whose form matches that of the stimulus, then some mechanism must suppress the grammatically inappropriate entry.

In the experiment in Laudanna et al. (2002 b), it was assessed whether the inhibitory effect equally applies to nouns and verbs or there are selective differences between them, the assumption being that, if nouns and verbs are differently affected by the stem homograph effect, this could shed light on possible representational differences at the lexical level. Thus, the effect on target verbs like *voluto* ("wanted", past participle, masc., sing.) when primed by a verb stem homograph like *volava* ("s/he flied", V, 1st conj., simple past) was compared with the effect obtained on target verbs (*stilare* "to draft", infinitive), whose stem is *stil*-, (V, 1st Conj.) when primed by a noun stem homograph (*stile* "style" (N, masc., sing.). It was also compared the effect on target nouns like *colpa* ("fault" (N, fem., sing.)), when primed by a noun stem homograph like *colpo* ("hit" (N, masc., sing.) with the effect obtained on target nouns (*mora* ("blackberry" (N, fem., sing.)), whose stem is *mor*-, when primed by a verb stem homograph, for instance *morire* ("to die" (V, 3rd Conj.). All the experimental conditions had a control condition where targets were kept constant and were preceded as primes by orthographically similar words beginning with an orthographic sequence (a "pseudo-stem") that was the same

as the target's stem, and a second control condition, in which unrelated primes were included.

The results showed that the interference effect on verb targets was stronger than on noun targets. In other terms, the results not only confirmed the already reported inhibitory effect for stem homographs when compared with both orthographically related and unrelated control conditions. They also allowed to further specify the stem homograph effect, at least in the sense that the effect is modulated by the grammatical relationship between prime and target. This provided further support for the view that orthographic lexical representations encode grammatical class information, with a consequent functional distinction between verbs and nouns. In the case of the inhibitory relation among stem homographs, if we assume that the effect reflects the organization of the input lexicon, where lexical items are processed as forms, then the described results may be interpreted as a support for the hypothesis that verbal and nominal stimuli are differently processed and/or represented in the input lexicon, at least as far as Italian is concerned. The reason why these results constitute an argument for the grammatical class representation hypothesis is that in the effect we found the relevant words (stem homographs) were neither semantically related, nor presented within a syntactic context. Hence, at least in this case, the explanation has to be circumscribed to a level of representation of grammatical class that is not affected by syntactic or semantic factors.

In conclusion, linguistic, neuropsychological and psycholinguistic design a complex picture of the distinction between nouns and verbs, with many points of convergences and also some discrepancies. When considering the available evidence from neuropsychological and psycholinguistic data, the distinction between nouns and verbs appears to be not much disputable. Linguistic data are less clear-cut, depending on the theoretical options and the languages under examination. However, there is an unanimous convergence on the fact that the very distinction is multi-faceted and cannot always be reduced to a single dimension of language processing or language description. More specifically, within the several dimensions underlying noun and verb processing, the representation of nouns and verbs as grammatical classes must be taken into account in order to explain the organization of lexical knowledge, the format of words' representations in the lexicon, and their theoretically possible breakdown.

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## *Footnotes*

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1 Because of the controversial evidence, in this paper we will not take position as far as the universality of the noun/verb distinction is concerned.

2 In Hebrew, all verbs and most of the nouns are comprised of two abstract morphemes, roots (typically consisting of three consonants) and word patterns (consisting of either a sequence of vowels or a sequence of vowels and consonants), and the phonemes of the two morphemes are interleaved.

3 In our view, the three classes of explanations should not be taken, as frequently happens, as mutually exclusive explanations for the observed noun-verb dissociations. Just for the reason that nouns and verbs differ along several dimensions, it is very unlikely that each possible dissociation must be always led back to the same cause.

4 Sometimes it has been argued that the dissociation arises because verbs are more difficult or more complex than nouns. This conclusion can be easily neutralized by the observation that there are several reports of patient whose performance is better on verbs than on nouns (e.g., Hillis & Caramazza 1995; Shapiro et al. 2000; Zingeser & Berndt 1990).

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