Levels of processing for nouns and verbs: some issues and controversies

Alessandro Laudanna

The perceived awareness that nouns and verbs are different linguistic objects in that they correspond to different kinds of referents, is among the most usually shared metalinguistic pieces of knowledge. Since the beginning of the reflection on human language, nouns and verbs have been considered as the basic parts of speech. In corroborating this observation, a major role has been played by the semantic properties of the two classes of words. Suffice it to give just two examples drawn from the ancient philosophical thought. In the Fourth Century B.C., in his Dialogue entitled "Cratylus", Plato stated that nouns and verbs are two distinct classes of signs that are used in order to refer to the reality; the former would make reference to the truth: they would designate those who perform actions as well as those who are or behave in some way; on the contrary, the latter would indicate actions and ways of being. Few decades later, in his treatise "On interpretation", Aristotle argued that, while by a noun we mean a sound significant by convention which has no reference to time, a verb, in addition to its proper meaning, bears with it the notion of time and is always something either predicable of, or present in some other thing.

Likewise, there is no danger of overstatement in saying that, even nowadays, the distinction between nouns and verbs – often and unconsciously – appears to us as a way of organizing our learning, our thoughts, and our knowledge. First and foremost for speakers of Indo-European languages, language is arranged in such a manner that on the one side it compels to think of the world in terms of nouns as names for objects and verbs as names for actions. On the other side, the phenomenological experience of the world - made up of entities and processes - favours and/or strengthens the characterization of nouns and verbs as labels for the former and the latter, respectively. The naive way of thinking, but sometimes even the scientific reasoning [1], is based on this approach to a supposedly meaningful partition of the world. It goes without saying that this quite unsophisticated analysis assumes that the words' classes reflect ontological categories and takes into consideration just some of the prototypical

instances of the two word classes of nouns and verbs. Thus, it does capture only a marginal part of the many existing differences between nouns and verbs. The real picture is much more composite: on the one hand, evidence from linguistics seems to suggest that the verb-noun distinction occurs on a continuum, and that in some languages it is far from being so obvious (Rijkhoff, this issue). On the other hand, in those languages where the boundary between nouns and verbs is less ambiguous, the distinction is articulated along several factors, and, even though different theoretical positions are maintained about the sources of the distinction, it is increasingly acknowledged that lexical, semantic, syntactic, morphological and pragmatic factors all operate, although in dissimilar fashions, in shaping the noun/verb distinction. Furthermore, it is very likely that these different factors are also at the basis of representational distinctions within each of the two word classes. For instance, in their paper in this issue, Tabossi & Collina show that in normal language production, the linguistic process of verb selection may be affected by extralinguistic phenomena such as speakers' conceptual organization of complex events.

Finally, and perhaps even more significantly, the noun/verb distinction is effective also at the cognitive and neural levels and, as such, it is referred to in some of the papers included in the present issue of the *Italian Journal of Linguistics* (see Cappa & Perani, this issue; Laudanna & Voghera, this issue; Luzzatti & Chierchia, this issue). One of the recurring questions in these papers is whether the observed behavioral and neurological differences between nouns and verbs are associated to semantic-conceptual differences or to other types of distinction (e.g., grammatical). Here we are faced with two alternative hypotheses.

The semantic-conceptual hypothesis reduces all the differences between the two categories to features - like concreteness and imageability - that are related to lexical meaning [2]. The focus, then, is on certain semantic dimensions typically related to prototypical nouns and verbs. With reference to this theoretical scheme, various semantic dimensions may be invoked: IMAGEABILITY, more frequently associated with nouns than with verbs; ABSTRACTNESS of semantic content, more or less pronounced depending on the presence of relational vs. sensory features; NUMBER OF SEMANTIC FEATURES which, according to some hypotheses, is on average lower for verbs than for nouns.

The concurrent hypotheses do not dispute that the distinction between nouns and verbs may be sometimes attributed to semantic factors. Rather, they state that there are some sets of linguistic and

experimental data that cannot be explained as the product of underlying semantic factors. In other words, it is true that some differences in processing nouns and verbs may be due to semantic features (as well as to other reasons such as the computation of the argument structure), but evidence of this nature cannot be used to exclude the possibility of differences grounded on other factors (Laudanna & Voghera, this issue).

The most reasonable answer to the debate arising from the cited papers, as well as from other published articles in the literature, is that it is probably wrong to speculate in terms of mutually exclusive explanations for the observed noun-verb dissociations. Since nouns and verbs differ along several dimensions, it is very unlikely that all the possible dissociations found may be ascribed to the same source. Nevertheless, the controversy between the semantic-conceptual hypothesis and the other, multidimensional, alternative hypotheses, leads back to the more general issue of how linguistic information is represented and organized in the mind/brain. A better understanding of this issue may be attained within the broader framework of cognitive science, looking at the representation, processing and use of nouns and verbs as computational processes, which manipulate several types of information, that has to be accessed and represented in a specifically organized way. From this point of view, the differences or the dissociations found between nouns and verbs may function as a possible crucial test for concurrent views of language processing. These views may be schematically summarized as follows.

On the one hand, cognitive accounts see the mind/brain as a computational device in which representations and computations operate on symbolically stored information. The internal knowledge about linguistic categories is taken to be modular, both anatomically and functionally. On this construal, the linguistic knowledge would be based on abstract levels of representation which define class membership. Cognitive explanations, even though embrace the view that the cognitive system exploits distinct representations in processing information, are not necessarily committed to any assumptions about the universality of the linguistic categories.

On the other hand, connectionist accounts like those underlying many computer simulations inspired either by the "classical" connectionist networks or by the artificial life style of modelling, hold that the cognitive-linguistic functioning is supported by a homogeneous network of interconnected units that generalizes frequently occurring input patterns on correlational bases and retrieves information in terms of the interaction of simple units which process elementary

variables (e.g., perceptual features). Linguistically based concepts articulated in terms of categories like "noun" and "verb" are supposed to be the epiphenomena of correlated clusters of elementary features. They are not thought to correspond to distinct cognitive representations; rather, they just mark different values of continuous variables like, for instance, perceptual features.

Obviously, the choice between the two alternative accounts cannot but be informed by empirical evidence, which can help us to choose which of the two classes of models is the most appropriate in explaining data deriving from linguistic, psychological and neuropsychological observations. The scrutiny of the majority of results reported and reviewed in the papers of this issue shows that the evidence from qualitatively different observations, at least for the present, is in favor of the existence of categorical representations, and cannot be explained as the result of the processing of simple and continuous properties. Another reason for assuming discrete, categorically based representations is that nouns and verbs are classes that not only mirror entities in the sensible world but also are repositories of linguistic knowledge that is essential for the appropriate language use in reference to morphological composition, phonological constraints, and syntactic production.

Summing up, it seems that the available patterns of results can be explained by assuming that processing occurs on categorically defined representations of nouns and verbs. Associationist explanations based on simulative models which substitute the several interacting components of symbolic models with a single input-output module fail to give an account of the different kinds of information putatively responsible for the results found. It remains to be ascertained whether these limitations of the simulation models reflect intrinsic inadequacies of associationist approaches or peculiar inadequacies of the available implementations (for a discussion on this issue see Laudanna, 2002).

One possibility to solve the controversy between semantic and non-semantic hypotheses about the cognitive and neural differences between nouns and verbs is given by the "semantic bootstrapping" hypothesis (Caramazza, 2001). This hypothesis holds that the correlation between verbs and actions, although not capable of explaining all the verb production deficits in patients with acquired disturbances of language, is worth in setting up the neural localization of knowledge about verbs during language acquisition. The relationships between the classes of objects and actions on the one hand, and nouns and verbs on the other, is useful to construe the basic rules of

syntax. Once these rules have been shaped, the syntactic-semantic correspondence can be loosened in such a way as to hold semantically non-prototypical examples of nouns and verbs. Based on this hypothesis, the initial categorization of actions as verbs is responsible for the localization of verb-specific syntactic information in brain areas adjacent to motor planning areas [3].

Despite the fact that the papers included in this issue represent only an attempt at clarifying the issue of interest, it is pleasing to conclude these brief introductory remarks by observing that, beyond the diversity in their approaches and contents, all of them, along with the many others in the scientific literature, testify how the research efforts expended in the fields of descriptive and formal linguistics, cognitive psychology and neuropsychology, neuroimaging and computer modelling, have broadened our understanding of the several dimensions along which nouns and verbs differ. More importantly, these papers not only deal with a number of these dimensions but also demonstrate, at least to some extent, how different levels of analysis and explanation may either directly collaborate in addressing the same issue, or be engaged in a parallel research effort such that the advancements achieved in one field increase the possibility to corroborate the results obtained in others or allow to generate new hypotheses for further research.

Address of the Author:

Department of Communication Sciences, University of Salerno, Via Ponte don Melillo, 84084 Fisciano (Sa), Italy <alaudanna@unisa.it> and Institute for Cognitive Sciences and Technologies - CNR, Viale Marx, 15, 00137 Roma, Italy <allaudan@ip.rm.cnr.it>

Footnotes

[1] For instance, some attempts at modelling the use and/or the acquisition of nouns and verbs by means of computer simulation are characterized (and probably undermined) by sets of assumptions of this form (see Parisi, Cangelosi & Falcetta, this issue).

[2] For sake of conciseness, I will not discuss other simple reductionist hypotheses that have been proposed: for instances, one of these states that the processing differences between nouns and verbs may be due to the fact that verbs determine the thematic and argument structures of sentences.

[3] Again with respect to acquisition, another important point relative to language use is raised by the paper by Longobardi & Camaioni (this issue). These authors review some interesting results showing that the proportion of verbs' and nouns' types and tokens produced by both mothers and children during the course

of acquisition is not universally fixed, but depends on the type and the characteristics of the language that is spoken.

Bibliographical References

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