On the nature of selective deficits involving nouns and verbs

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In this paper we address the status of Verb-Noun (V-N) dissociation in aphasic patients, building on the results of a large-scale study (Luzzatti et al. 2002). We first briefly review the main positions that have emerged in the rich debate on this topic. We then reconsider the findings of Luzzatti et al. in light of such debate, offering a partially novel interpretation of their results. Our main (tentative) conclusions are the following. First, Luzzatti et al. do provide further evidence that V-N dissociations cannot be wholly explained in terms of extralinguistic aspects of our sensory/conceptual system. Second, such evidence can be accounted for, perhaps optimally, under the assumption that argument structure is what is involved in damage to verbs. A damage to argument structure would, in fact, not only selectively affect verbs over nouns; it would also arguably determine the type of compensatory strategy to be used in such cases. In particular, the easier it is for an action to be coded in mental visual images, the easier it will be to restore the corresponding argument structure (by extracting from the events the corresponding theta-roles). Selective damage to nouns, on the other hand, cannot as readily be accounted for in terms of damage to argument structure and, in fact, it must be caused by different underlying mechanisms.[*]

1. Introduction

As is well known, aphasics often show a Verb-Noun (V-N) dissociation. In some patients use of verbs is impaired, while use of nouns is relatively spared. In other patients the opposite pattern may emerge. This is an area of study in which neuropsychology and linguistics can fruitfully interact, and in fact have already done so. In this paper we would like to discuss the status of the ongoing debate on this topic, as we perceive it, building on a large scale study of aphasic subjects, presented in Luzzatti et al. (2002). The present paper is organized as follows. First, in the rest of this introduction we review some of the relevant background. Then, in section 2, we summarize the results of Luzzatti et al. (2002). In section 3, we discuss such results against the background of the debate reviewed in the introduction. We offer a partially new interpretation of such results, in the light of current linguistic theory, and discuss some problems

that remain open. Finally, in section 4, some (tentative) general conclusions are offered.

1.1. Cognitive neuropsychology and neurolinguisitcs

Cognitive neuropsychology (i.e. the branch of experimental psychology that studies cognitive functions) enables us to test multicomponential models of complex cognitive capacities structured in a modular way. In particular, during the 80's much important work has shown how one can investigate such capacities through the study of patients suffering from neuropsychological damage (Fodor 1983; Marshall 1984; Caramazza 1986). Typically, models of the normal functioning of a given capacity hypothesize different subunits that play a role in processing the relevant material. The behavior of a certain pathological subject may confirm or disconfirm the functional independence of the hypothesized subunits and/or their hierarchical organization. More specifically, two subcomponents may be damaged independently of each other, and hence we expect to find a double dissociation of the two corresponding functions. If such dissociation is indeed found we have confirming evidence of the independence of the subunits. Usually, though not always, such independence may have an anatomical basis (e.g. when lesions involve two separate areas of the brain).

The study of aphasia is a prime example of the effectiveness of this research paradigm, as we hope to illustrate through our review of V-N dissociation. For this purpose it may be useful to recall some basic information on aphasic language impairments and their description.

Aphasia is a language impairment that affects the production and comprehension of verbal messages in individuals with a normal language acquisition history. Typically, this acquired disorder results from a left-hemisphere brain lesion and it involves, in general, different linguistic units and modalities.

The description of language disorders is usually based on the characteristics of the spontaneous speech output (see table 1). These include the fluency dimension and the degree of impairment of the individual linguistic units. The variables used for a fluency judgement are fairly heterogeneous, ranging from impairments of the articulatory motor control (apraxia of speech), reduced rate of speech (verbal inertia), and primary damage to the syntactic realization of

sentences. The latter impairment may emerge in two antithetical types of damage, a first one characterized by lack of grammatical complexity and omission of functional elements (agrammatism), a second one by normal sentence complexity, however with improper use of functional elements (paragrammatism).

Table 1. Major types of aphasia and principal deficits

Major types of aphasia	Principal deficits
Fluent aphasia	
Wernicke's aphasia	Lexical, phonological and morpho-syntactic
Conduction aphasia	Phonological
Anomic aphasia	Word retrieval
Transcortical sensory aphasia	Lexical-semantic both in production and in comprehension
Nonfluent aphasia	
Agrammatism (Broca's aphasia)	Telegraphic speech output
Nonagrammatic nonfluent aphasia (nonagrammatic Broca's aphasia)	Slow and effortful speech; reduced syntactic structure, but no telegraphic output (± apraxia of speech)
Global aphasia	Severe articulatory, lexical, phonological and morphosyntactic

FLUENT aphasic output is abundant; articulation, prosody and phrase length are normal; sentences have a complex syntactic structure, but do contain many interruptions, agreement errors and substitutions of function words (see Table 1). The lexical component is impaired as evidenced by the presence of word finding difficulties and lexical substitutions, and phonology is affected, resulting in phonemic substitutions and phonemic neologisms. Wernicke's aphasia is the prototypical fluent language disorder: patients show an almost homogeneous impairment of the phonemic, syntactic and lexical-semantic components. In contrast, a lexical access disorder is prominent in anomic aphasia, a phonological impairment (and therefore a repetition deficit) typifies conduction aphasia, and a semantic deficit (or a deficit of the lexical-semantic interface) characterizes transcortical sensory aphasia. The impairment of comprehension varies according to the severity of the language disorder, is minimal

or mild in conduction aphasia and anomic aphasia, and severe in transcortical sensory aphasia.

NONFLUENT speech output is sparse, phrases are short, words are produced with effort and with little prosody, or are poorly articulated; sentence structure is simplified and lacks of subordinate clauses; function words are often omitted. *Broca's aphasia* is the prototypical nonfluent language disorder. Nonfluency is caused either by the impairment of syntactic structure (agrammatism), or by an articulation deficit (apraxia of speech). Global aphasia is the most severe type of nonfluent language disorder. Speech is usually reduced to a few stereotyped utterances and there is almost always a severe disorder of articulation. Comprehension and repetition are also severely impaired.

Various types of aphasia give rise to the phenomenon of double dissociations, which is directly relevant for testing the structure of language processing units. An example of double dissociation that may be observed in aphasic subjects affects names of natural versus artificial objects, a dissociation whose basis is as of yet not fully understood. As a consequence of inferior temporal lesions a peculiar impairment can emerge in the use of names of natural objects and/or of the underlying conceptual knowledge that leaves the corresponding abilities concerning artificial objects intact. A patient with this impairment can for example name or describe a wrench, a corkscrew or a sledge, but not a strawberry, a zebra or a snake. Interestingly the opposite dissociation is also attested. Category-specific deficits such as these have been explained on one side in terms of a separate functional and anatomical organization of lexical or lexical-semantic knowledge of natural versus artificial objects (Hart et al. 1985; Caramazza & Shelton 1998). However, the same data can also be accounted in terms of the different type of knowledge that underlies the two classes of objects (as opposed to a categorial distinction in the lexicon). According to this hypothesis, natural objects are coded through prevalently visual information (e.g., form and color), while artifacts rely on prevalently functional information (e.g. their typical use) (Warrington & McCarthy, 1983; Warrington & Shallice 1984). Evidence in favor of this view comes from those patients who, for example, cannot describe the mantle of a tiger but have extensive knowledge of its typical dispositional properties (e.g. it is ferocious, lives in the jungle, etc.). From this perspective, the double dissociation stems from the separate anatomical organization of visual and functional attributes, with the former located in the visual associative *temporal-occipital* cortex, and the latter in the *parietal* cortex.

The different conceptual representation underlying natural objects and artifacts is confirmed by several imaging studies (e.g. Perani et al. 1995; Martin et al. 1996), which showed temporal activation during tasks requiring semantic judgements on natural items and parietal activation for semantic judgements on artifacts.

1.2. Dissociated impairment of verbs and nouns

Turning now to our main concern, the V-N double dissociations have been the object of intense investigation over the past decades (for an overview, see Luzzatti et al., 2002 and references therein).

Originally it was believed that verb retrieval was more impaired in agrammatic patients, while anomic patients had greater difficulty with nouns (McCarthy & Warrington 1985; Zingeser & Berndt 1988, 1990; Chen & Bates 1988; Bates et al. 1991; Daniele et al. 1994). However it soon emerged that this generalization was untenable, since several cases of *verb retrieval damage* in *non-agrammatic* patients were found (for instance, Williams & Canter 1987; Kohn et al. 1989; Berndt et al. 1997).

More recently, Jonkers & Bastiaanse (1998) suggested that verbs and nouns dissociate in *one direction* only, as *all aphasic* patients have more difficulty retrieving verbs than nouns. The opposite dissociation would be an artifact resulting from linguistic and psycholinguistic variables that are relevant in determining word retrieval, and word-retrieval deficits.

In a similar vein, Bird and coworkers (2000) explained V-N dissociations in terms of the different weight of the underlying perceptual and lexical-semantic features. This type of account builds on the one offered by Warrington & McCarthy (1983) to account for dissociations between natural vs. artificial objects. Essentially, knowledge of verbs would be predominantly functional, while knowledge of (concrete) nouns predominantly visual. The interest of this hypothesis lies in the fact that it enables one to explain V-N dissociation without direct appeal to grammatical categories, thereby, reducing the relevant phenomena to an independently established and undoubtedly real functional and anatomical distinction.

We shall come back extensively to this issue later. We may, however, notice already at this preliminary stage that it is implausible that this line of explanation extends to *all cases* of Verb-Noun dissociations. For example, Caramazza and coworkers describe cases of Noun- and Verb-superiority in *single* oral or written, input or output modalities. I.e. certain patients confronted with the picture of an

action could name it orally (verb naming), but not in writing (Caramazza & Hillis 1991), while another patient made many errors on nouns in spoken naming, but showed greater impairment for verbs in written word comprehension (Hillis & Caramazza 1995). Finally, a third case showed a higher rate of impairment for nouns in spoken naming, but for verbs in written naming (Rapp & Caramazza in press). These findings (a) are inconsistent with the idea that Verb-Noun dissociation are caused by the impairment of the underlying associated knowledge, and (b) seem to suggest selective damage of specifically linguistic categories.

The work of Caramazza and coworkers views V-N dissociations as a specifically linguistic deficit. For the present purposes we can view language as a structured lexicon and a combinatorial apparatus; and with regard to this distinction, the deficit in question, according to Caramazza, concerns primarily the structured lexicon. But other hypotheses are also conceivable. For example, Friedmann et al. (2000) locates the problem of V-N dissociation in the combinatorial apparatus. In particular they suggest that the verb retrieval deficit observed in agrammatic patients "shall not be explained as a selective lexical impairment, but as a syntactic impairment causing inability to move verbs to the relevant functional categories, and to inflect them correctly". The idea is that agrammatic patients have a simplified clause structure where the upper portion of the syntactic tree (that typically encodes "functional" information about tense, aspect, etc.) gets "pruned". Accordingly:

> "When agrammatics have to inflect a verb and move it to a pruned position, they sometimes prefer not to produce the verb at all. The deficit, then, is not a purely lexical deficit in the 'verb lexicon'. It is modulated, rather, by syntactic structure, and can be explained within the framework of pruned trees and the resulting verb movement deficit. Thus, verb omissions may result from the same deficit that causes verb inflection errors: a syntactic deficit." (Friedmann, 2000).

In considering verb impairments, it should also be kept in mind that verbs are associated with different argument structures. It has occasionally been noted that type/complexity of argument structures does play a role in the performance of verb-impaired patients (Thompson et al. 1997). However, the results obtained so far in this domain have not lead as of yet to the identification of robust empirical generalizations (1).

Summing up, the result of previous work on V-N dissociations shows rich and differentiated landscape. On the one hand several important cases of such dissociations have been documented in detail. On the other hand many different kinds of accounts have been offered. Some such accounts emphasize the role of the extralinguistic knowledge that underlies the Verb-Noun distinction; others put the burden of explanation on grammar specific notions (be they located primarily in the lexicon or primarily in the syntactic combinatorics). It is against this background that the work of Luzzatti et al. (2002) finds its main justification. Such a work studies a relatively large sample of 58 aphasic patients with the intent of sorting out the weight of different factors that may be involved in the dissociation in question. The objectives of the study were: (i) to assess the prevalence of selective impairment of verbs and nouns; (ii) to ascertain whether verb- or noun-superiority is associated with a particular type of aphasia; (iii) to ascertain whether there are differences among verb types; (iv) to elucidate the mechanisms underlying verb-noun dissociation. We now turn to a brief presentation of the main results of such work.

2. Main results of Luzzatti et al.'s (2002) study

The study consisted of a picture naming task (of objects and of actions) involving 58 aphasic patients and 45 normal controls. Thirty-six of the aphasic patients were suffering from fluent language disorders, and 15 from nonfluent language disorders. Thirteen of the fluent aphasic patients were classified as suffering from anomic aphasia and 23 from Wernicke's aphasia. Of the 15 nonfluent aphasic patients, six showed typical agrammatic speech output, with omission of function words, verbs in non-finite form, etc., while the remaining nine showed slow rate of speech and simplified syntactic structure, but no classic telegraphic output. Seven patients were affected by a language disorder that could not be classified unambiguously into any of the major aphasic groups.

Participants were given a visual naming task with 30 objects and 40 actions.

The major lexical (oral word frequency, age of acquisition) and semantic variables (familiarity with the underlying concept, imageability) that have been shown to influence lexical retrieval were considered.

Verbs were distinguished by principal functional classes: i.e.

transitive, and intransitive verbs (the latter further divided in unergative and unaccusative verbs). Sixteen pictures elicited the production of a transitive verb (e.g. *legare* 'to bind'; *misurare* 'to measure'; *tagliare* 'to cut'; *versare* 'to pour'). Following contemporary linguistic principles, intransitive verbs were divided in two further groups. Twelve pictures elicited the production of unergative verbs (e.g. *dormire* 'to sleep'; *camminare* 'to walk'; *nuotare* 'to swim'; *piangere* 'to cry'), 12 items of unaccusative verbs (e.g. *cadere* 'to fall'; *crollare* 'to collapse'; *scivolare* 'to slip'; *scoppiare* 'to explode'). On the surface, unaccusative verbs, like intransitive verbs, do not take a direct object. However, typically, the grammatical subject of unaccusative verbs is not the agent but the theme of the action. This makes active unaccusatives similar to the passive of transitive verbs. In fact, as in passive sentences, Italian unaccusative verbs take the auxiliary *essere* (to be) rather than *avere* (to have). The unergative verbs are, per contrast, the *avere*-selecting intransitive verbs.

UNACCUSATIVE VERBS
(1)   la casa crolla   la casa è crollata [auxiliary: *essere*]
       'the house collapses'   'the house has [lit.: *is*] collapsed'

UNERGATIVE VERBS
(2)   la ragazza dorme   la ragazza ha dormito [auxiliary: *avere*]
       'the girl sleeps'   'the girl *has* slept'

TRANSITIVE VERBS
(3)   la ragazza taglia la torta la ragazza ha tagliato la torta [auxiliary: *avere*]
       'the girl cuts the cake'   'the girl *has* cut the cake'

TRANSITIVE PASSIVE SENTENCES
(4)   la torta è tagliata (dalla ragazza) [auxiliary: *essere*]
       'the cake *is* cut (by the girl)'

The data obtained from the naming task were compared among the major aphasic subgroups and analyzed as single cases using a logistic regression procedure.

On the group study, fluent aphasic patients obtained a performance for nouns that is slightly better than that for verbs (N = 49%; V = 41%). Such a difference was much larger in the Wernicke's patients (N = 48%; V = 33%), while in the anomic patients there was a better performance with verbs, a difference however that did not reach the significance level (N = 51%; V = 55%). Nonfluent aphasic

patients, on the contrary, performed much better on nouns than on verbs (N = 67%; V: 43%). This mean difference was even larger in agrammatic patients (N = 71%; V: 34%).

For what concerns the naming ability of different verb classes, fluent aphasic patients did not show any difference of performance (unaccusatives 36%, unergatives 42%, transitives 43%), whereas non-fluent patients - with and without telegraphic speech - were significantly more impaired on unaccusative (34%) than on unergative verbs (50%). Furthermore, the agrammatic cases were severely impaired also on transitive verbs (25%).

The authors also wanted to analyze variations in the performances of the individual patients. Single case analysis (Logistic regression: Mc Cullagh & Nelder 1983) made it possible to study the effects of the variables that might have influenced the naming performance. Variables were both categorical (verbs versus nouns) and continuous (word frequency, familiarity, imageability).

Twenty-six patients showed dissociated naming ability of verbs and nouns. Naming of nouns was more impaired in 6 cases, that of verbs in the remaining 20. Five of the 6 agrammatic patients were significantly more impaired with verbs. Among the 13 patients suffering from anomic aphasia, 7 obtained a dissociated naming impairment, 5 of them with verb- and 2 with noun-superiority. On the contrary, of the 23 Wernicke's patients, 7 had superiority for nouns and 1 for verbs.

The logistic regression procedure also allows to test the effect of continuous variables (e.g. word frequency and imageability) to explain the naming performance of the single aphasic patients on each individual item. It turns out that word frequency has significant effect on the naming performance of 11 patients and in particular of 5 from the 6 patients with specific impairment of nouns. On the contrary, imageability has significant effect in 29 patients, and in particular in all 20 patients with specific impairment of verbs. Finally, among the 32 non-dissociated cases, the effect of word frequency and of imageability is significant in only 4 and 7 cases, respectively.

A multivariate logistic regression was carried out on those patients who showed a significant (p < .05) verb- or noun-superiority combined with a significant effect of one (or more) of the concomitant variables. The objective of the analysis was to assess whether verb- or noun-superiority held independently of the effect of the continuous variables. After the introduction of word frequency in the regression model, three of the five patients with verb superiority no longer reached significance. On the other hand, after the introduction of

imageability, only two of the 20 noun-superiority cases remained significant. Such a reduction of noun-verb dissociations indicates that the superiority of either grammatical classes depends of – at least in some of the cases – on word frequency and imageability differences between nouns and verbs. However, the effect remained significant in 2 verb-superiority and in 2 noun-superiority cases even after the imageability and word frequency effects had been factored out.

The results of our single case studies are provided in Table 2. The main empirical generalizations emerging from such results can be summarized as follows:

(1) The V-N dissociation is bidirectional. Most aphasic patients show verb deficits; but the opposite condition also unequivocally emerges.

(2) Selective impairments of verbs is the only form of dissociation observable in agrammatic patients. Both V>N and N>V dissociations can instead be observed among fluent aphasic patients.

(3) Nonfluent patients (whether agrammatic or not) have difficulty with unaccusative verbs. A deficit affecting transitive verbs only emerges in agrammatic patients; they appear to be sensitive to the number of arguments in a verb entry.

(4) In the majority of cases, word frequency and imageability correlate with dissociation patterns in a significant manner. Word frequency affects noun retrieval; imageability verb retrieval.

(5) In about 1/3 of the cases, a genuine grammatical class effect persists, even when imageability and word frequency effects are factored out.

We now turn to a general discussion of these findings.

3. Discussion

We will start out by discussing some general issues our methodology raises. We will then turn to a discussion of the main effects we found (imageability, word frequency, argument structure, etc.).

A preliminary point concerning the status of the categories Nouns vs. Verbs in current linguistic theory should be addressed. Such categorial contrast manifests itself differently in different languages. In fact, even for languages like English or Italian it has been argued that nouns and verbs may well have a common underlying

Table 2. Results of the multiple single-case study for the 26 patients with dissociated naming ability on verbs and nouns (from Luzzatti et al., 2002).

					Superiority effects (verbs vs nouns) univariate a. bivariate analyses						Effect of the concomitant variables on the naming ability on verbs and nouns					
Pt	Sup	Aph type	%N	%V	N-V X^2	p	N-V + WF X^2	p	N-V + IM X^2	p	WF X^2	p	IM X^2	p	FAM X^2	p
9	V>N	A	13	58	12.1	<.001	10.1	<.005	3.2		7.5	<.01	10.3	.001	4.7	<.05
5	V>N	A	7	45	9.3	<.005	8.0	.005			8.4	<.005	4.3	<.05	10.4	.001
20	V>N	W	13	40	5.5	<.05					1.6		2.6		6.0	<.05
8	V>N	A	37	65	5.4	<.05	2.7				8.1	<.005	1.5		15.0	<.001
7	V>N	A	13	38	4.7	<.05	3.3				6.6	.01	1.5		6.5	.01
13	V>N	A	43	68	4.0	<.05	2.6				4.2	<.05	3.6		5.6	<.05
21	N>V	W	73	8	23.4	<.001			0		0.3		19.2	<.001	7.7	.01
49	N>V	Agr	87	30	18.1	<.001			1.6		0		17.9	<.001	0.8	
24	N>V	W	57	8	15.6	<.001			0.3		1.4		14.9	<.001	5.1	<.05
58	N>V	NC	53	5	14.4	<.001			1.4		0.3		12.8	<.001	2.5	
48	N>V	Agr	83	35	14.2	<.001	12.6	<.001	0.4		4.1	<.05	15.1	<.001	0.1	
42	N>V	nF-	53	3	12.6	<.001			0.7		0.7		12.2	<.001	3.6	
32	N>V	W	47	10	10.3	.001			0		0.2		11.0	<.001	0.5	
16	N>V	W	87	48	10.0	<.005	14.7	<.001	5.2	<.05	4.3	<.05	6.7	<.01	1.8	
51	N>V	Agr	80	45	8.1	<.005			0		0.9		9.7	.005	5.5	<.05
6	N>V	A	80	45	8.1	<.005			1.1		0		7.4	<.01	2.4	
53	N>V	NC	47	15	7.8	.005			0.8		0.5		10.3	.001	1.9	
30	N>V	W	47	15	7.8	.005			0.2		1.6		9.5	.005	9.7	<.005
1	N>V	A	70	40	7.3	<.01			1.4		1.7		6	<.05	1.4	
47	N>V	Agr	70	38	7.0	<.01			0.4		0		6.8	<.01	3.1	
54	N>V	NC	70	38	7.0	<.01			0.1		0.2		7.5	<.01	6.0	.01
50	N>V	Agr	70	40	6.0	<.05			0.2		0.3		6.3	.01	4.5	<.05
25	N>V	W	70	40	6.0	<.05			3.8	.05	0.6		12.2	.001	2.7	
52	N>V	NC	57	28	5.9	<.05			1.0		0		9.2	<.005	5.4	<.05
27	N>V	W	27	5	5.4	<.05			1.7		0.8		6.6	<.01	3.5	
57	N>V	NC	70	45	4.2	<.05			0.1		0		5.9	<.05	0.9	
Verb superiority cases			6						5 (83%)				2 (33%)		6 (100%)	
(") after disentangling for WF							2									
Noun superiority cases			20						2 (10%)				20 (100%)		7 (33%)	
(") after disentangling for IM									2							

Pt = patient; Sup = noun- or verb-superiority (univariate analysis); Aph type = aphasia type (A = anomic, W = Wernicke's, Agr = agrammatic, nF- = non-agrammatic nonfluent, NC = non classifiable aphasia); N = naming of nouns; V = naming of verbs; 1V = univariate, 2V = bivariate analysis; WF= word frequency; IM = imageability; FAM = familiarity. P-values for bivariate analyses refer to the N-V parameter only (the p-value for the concomitant variables included in the model (WF or IM) being implicitly significant (p < .05)).

source. For example, there might bean underspecified stem that can be realized either as a verb or as a noun, depending on the morphosyntactic processes it enters into. While this is an interesting hypothesis which might well turn out to be correct, the fact remains that through a variety of devices (ranging from morphology to positions in the clause) languages do seem to distinguish, at some point, verb roles from noun roles. The former (i.e. verbs) are typically heads of predicative complexes. The latter (i.e. nouns) typically play the role of arguments in predicative structures. We are going, therefore, to assume (in keeping with much current work) that there is a derivational phase or level of grammatical representation (in the lexicon or, possibly, in the syntax) where Nouns and Verbs are structurally (categorially) distinguished. Our concern in the present study is whether such distinction (which we take to be well motivated on linguistic grounds) also manifests itself in tangible forms in language processing and/or in the functional organization of the brain.

With regard to our experimental methodology, one of the chief characteristics of our study is that we are dealing with a relatively large and varied sample of subjects, whose members present different kinds of damage. Hence the causes of their dissociation patterns (even when such patterns appear to be similar) are likely to be as varied as the population. The present technique doesn't allow us to readily tease apart potential causes of the dissociation. It may, however, help us identify tendencies which remain constant across various kinds of deficits. To exemplify concretely, suppose, drawing from grammar based accounts, that in some patients, N>V superiority is caused by a syntactic damage consisting in the loss of certain functional categories associated with verbs (say T(ense), as suggested by Friedmann), while in other patients it is caused by a lexical damage to the category V (possibly in the form of loss of information coded in verb lemmas). Our methodology wouldn't be able to tease apart these two a priori equally conceivable causes. This is so, among other reasons, because it is presently unclear whether answers in picture naming of nouns and verbs are "reduced" sentences (which would require producing a significant portion of clause structure) or simple words (which is likely to call upon a prevalently lexical knowledge). It is, therefore, hard to sort out problems centered on the lexicon from problems having to do with the computational system. It follows that if we find a common effect across N>V patients, it must be something that the different causing factors may have in common. Our experimental procedure does give us information capable of constraining theoretical proposals, as we will see.

A further factor to bear in mind is that pictures are static. This makes them suitable to unambiguously portray concrete, typically static objects (e.g., chairs or hammers) such as those identified by sortals (i.e. names of sorts or kinds of entities). But it makes them less suited to portray relational nouns (like uncle, or neighbor) and dynamic verbs (run, kiss), or psychological statives (know, love). Thus, for example, the higher rate of N>V vs. V>N superiority cases might be caused, at least in part, by some difficulty in decoding movement from a static snapshot, rather than with anything having to do with language [2]. A particularly interesting case to consider, in this connection, is the following. Imagine the picture of an explosion. It can be obviously described equally well through the noun 'explosion' or the verb 'explode'. Testing V-N dissociations for minimal pairs of this sort may be particularly telling, as some of the most highly relevant factors (like imageability) remain clearly constant in cases of this sort (while other factors, like word frequency, which may vary, can presumably be balanced).

3.1. The imageability effect in patients with N>V superiority

Turning now to the effects we found in our study, a quite robust one is that imageability affects significantly naming of actions. Performance improves if the action is more 'imaginable'. Moreover, if we factor imageability out (through a multivariate analysis), N superiority in many cases (18 out of 20 in our sample) disappears. At one level, this is not so surprising. As noted above, part of the problems with verbs may be due simply to the difficulty of encoding actions in pictures. If an action is more imaginable, it will be easier to match the stimulus with a stored mental structural description of the action. So, it is to be expected that the task of finding the appropriate lexical item will be somewhat facilitated by enhanced imageability.

However, even when we factor out imageability, there are cases in which naming of pictures with verbs remains significantly more impaired than naming of pictures with nouns. This supports the conclusion that difficulty with verbs in aphasics cannot be wholly reduced to the inherent difficulty one has in representing dynamic and/or less imaginable eventualities.

While this might be in and of itself interesting, there is still something to understand here, having to do with the robustness of the imageability effect. Why is it that patients that have difficulty with verbs perform so much better when verbs refer to actions that

are more imaginable (while no similar effect is detected in patients who have difficulty with nouns)?

Suppose you have a word processor that in normal conditions can read and process the symbols 'N' and 'V', attached to words. Suppose, furthermore, that your machine gets damaged and looses its capacity to recognize one such symbol. Suppose, finally, that such machine has some compensatory strategy that enables it to learn words that are particularly frequent and easy to imagine. Would you expect an imageability effect only on the words marked V and a frequency effect only on those marked N? It would seem not. Why not the other way around? Or why not, more plausibly, some graded effect of both imageability and frequency on both categories? If we think in terms of a damage to categories 'N' or 'V' as such, we are at a loss in understanding the pattern we actually find. To try to understand what goes on, we have to look more closely at the different structure of nouns vs. verbs. In what follows, we offer some preliminary considerations in this direction, drawing from contemporary linguistic theory. To anticipate, our hypothesis is the following. What gets actually damaged is argument structure on the one hand and/or something like the case checking mechanism or perhaps referential schemata on the other. The first kind of damage is what affects selectively verbs, the second nouns. If we adopt this hypothesis the existence of an imageability effect on the former and of a frequency effect on the latter arguably falls into place.

A fundamental characteristic of verbs is that they are argument taking. They represent eventualities typically in the form of relations among the protagonists of such eventualities. For example, *give* characterizes an event *e* which involves a three place relation between an agent (x_{AG}, the giver) a theme (y_{TH}, what is given) and a goal(z_{GO}, the end point of the transaction). This is captured in many different ways in current approaches (see, for example, Dowty 1989 for a discussion of influential linguistic approaches and Jonkers 2000 for a review of the impact of such approaches on aphasia research). One is to assume that as part of the information stored in the lexical entry of verbs we find the following:

(5) a. /run/ $RUN(e, X_{AG})$
     b. /eat/ $EAT(e, X_{AG}, y_{TH})$
     c. /give/ $GIVE(e, X_{AG}, y_{TH}, z_{GO})$

The formulae in (5) can be thought of as listing the obligatory

arguments of a verb, i.e. its *adicity*, as it is often called. We assume, in keeping with most current proposals (see e.g. Parsons 1990), that all verbs have an implicit (i.e. covert) argument ranging over eventualities, which gets modified by temporal and aspectual operators and, possibly, adverbs. The remaining arguments indicated in (5) are the participants in the event. They have a label (agent, theme, goal, ...) indicating their thematic role. The external argument (intuitively, the one corresponding to the subject) is marked in boldface. As is well known, some verbs (unaccusatives and so called impersonal ones like *seem*) do not have an external argument. Obligatory arguments (whether external or internal) must be syntactically projected, i.e. there must be corresponding nodes in the syntactic tree suitably filled with lexical material that provides the argument slots of the verb with semantic content. Within parametric/minimalistic frameworks the syntactic projection of obligatory arguments is governed by the Projection Principle. The exemplification provided in (5) is, to be sure, a gross oversimplification. However, we are not so much concerned here with the details of formalization, as with the general idea that information about argument structure and how it mediates between syntax and semantics must be part of verb entries (a fact that any framework must somehow accommodate).

Now, it is important to underscore that a given eventuality can often be coded through several entries of varying adicity. Consider for example food-consumption. One and the same eventuality of food consumption by John might be couched in any of the following ways:

(6) a. John is dining   a'. *John is dining pasta
     b. John is eating   b'. John is eating pasta
     c.*John is devouring   c'. John is devouring pasta

Even though the action of food consumption typically involves two components (an agent and a theme), it can be lexicalized as involving fewer protagonists. The verb *dine* is obligatorily intransitive; *eat* can be transitive or intransitive; *devour* is predominantly transitive. Facts of this sort are well known and much discussed in the literature (see e.g. Dowty 1989, and references therein). Another standard illustration can be given by minimal pairs of the following sort:

(7) a. This picture (SUBJ.) pleases John (DIR.OBJ.) very much
     b. John (SUBJ.) likes this picture (DIR. OBJ.) very much
     c. Questo quadro (SUBJ.) piace molto a Gianni (IND. OBJ.)

     SUBJ. = subject; DIR. OBJ. = direct object; IND. OBJ. = indirect object

In this case the same psychological state can be lexicalized by coding the experiencer as the object (direct, (7a), or indirect, (7c)) or as the subject (7b). The general point illustrated by these examples is that typically, an event has a canonical number of participants. But how many of such participants are taken as obligatory arguments by a lexical entry and in which form they are coded may vary, to a degree, both within a language (as (6-7) illustrate) and crosslinguistically (cf. (7b) vs. (7c)). In other terms, the path from an event or state of affairs to its linguistic coding (i.e. the lexicalization of an event) partly is constrained by the inherent nature of the event, but partly appears to be a relatively autonomous grammatical choice. This in turn entails that our perceptual/conceptual representation of an action and its encoding in grammar have a degree of independence. This may well be relevant in trying to understand what is going with aphasics. Let us see how.

For one thing, we now have a *theoretical* reason to doubt that direct damage at the level of perceptual/conceptual representations should by itself give raise to an impairment in, say, verb use. Our reason rests on the observation that representation of verb structure is likely to be, as we just saw, to a certain extent, autonomous of the perceptual/conceptual representation of eventualities. Hence it is unclear why damage at one level should automatically carry along a damage at the other. At the same time, it may well make good sense that in presence of damage to argument (thematic) structure, imageability might have an impact on performance in use of verbs. Let us see why.

Structures such as those in (5) must wind up eventually being linked to the concrete eventualities they describe. Evidently, such a link must go through the way in which we represent the relevant eventualities (e.g. eating, jumping, kissing, etc.) at the perceptual and/or conceptual level. There must be some kind of schemata we use to link up linguistic information to our environment. And for eventalities that have a relatively high degree of imageability (like verbs expressing concrete actions, as opposed to ones expressing, e.g., psychological states), visual mental representations will naturally tend to play a central role in establishing the relevant link. Suppose now that something in the lexical entry of verbs gets damaged. Let us assume that a lexical entry is a structure containing all the information for its competent use specific to an item. This assumption is pretty standard in linguistics, as well as in psycholinguistic theories of lexical representations (cf. e.g. Levelt et al.'s (1999)) notion of *lemma*). At the present level of generality, the details of how the lexic-

al items are structured don't really matter (though we may assume, for concreteness, they involve representations such as those in (5)). What really counts is that lexical entries must code argument/thematic structure. Now, we don't know exactly *what* may get damaged in an entry. It could be a damage to argument structure as such (for example, the loss of representations such as those in (5), or an impaired ability at decoding them, or at using them in creating syntactic structures, etc.). It could also be a damage to some other aspect of the entry (say something affecting the category VERB as such), which would, however, necessarily have an impact on other information associated with verbs. However, the (complex) details may eventually be fleshed out, the primary impact of any damage to lexical entries of verbs will be on the linguistic coding of argument structure, simply because this is absolutely central to their use. Verbs *are* their argument structure, so to say. How could, then, one make up for such an impairment? What kind of compensatory strategy might our cognitive system seek? The task is linking a visual stimulus (a picture) to a linguistic representation (a word or a reduced sentence, as the case may be) endowed with argument structure. We have conjectured that argument structures are linked to concrete eventualities through perceptual and conceptual schemata. In the case of concrete actions, such schemata will rely on mental images, which will be all the more vivid, as the relevant action becomes easier to imagine. It is plausible that such stored mental images will enable one to recover the lost argument structure. From a visual characterization of an act of eating, we will be able to identify, at least as a default, two canonical protagonists, an agent and a theme. We said that there is no necessarily unique path from events to argument structures. But there surely are constraints and defaults. For example, an eventuality that typically has two protagonists will be encoded through a word that takes (at least optionally) two arguments. Thus, accessing such visual mental representations we might well be able to access and even partly restore the fuzzy/damaged lexical entry. So under the view that verb deficits involve a damage to argument/thematic structure we do come to indeed expect an impact of imageability on performance that very much goes in the same direction we found in the present experiment.

Consider, per contrast, the case of nouns. Many nouns simply do not have argument structure in the relevant sense. They are not argument-taking. In particular, this is the case for all the nouns used in the present experiment. They are all sortals referring to concrete objects. This has at least two immediate consequences. First, if some-

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thing specifically damages argument structure, it won't affect nouns; at least not those considered in the present experiment, for they have none. And second, our capacity to represent (dynamic) events through visual mental images will play no role in however the lexical entry of nouns is linked to the objects they apply to.

A few caveats are in order. There are of course nouns that are, in some sense, argument taking. We mentioned above the case of inherently relational nouns, like *neighbor*, *enemy*, *mother*, etc. A further important type is that of deverbal nouns, and, more generally, nouns that are morphologically related to verbs (such as *arrive/arrival*, *destroy/destruction*, *attack/attack*, etc.). Nouns of this kind are particularly interesting, as they seem to inherit fully the thematic structure of the related verbs. Consider for example the following phrases:

(8)   a. John donated a rare book to the library
      b. John's donation of a rare book to the library

So what of our hypothesis? It may seem that we are predicting that damage to thematic structure should affect these kind of nominals much like it affects verbs. Though conceivable, this conclusion is not wholly warranted. Even if some preservation of thematic structure is clearly present here, it is also clear that the way in which nominals can be said to be argument taking is clearly very different form the ways in which verbs are. This is certainly the case for languages like English or Italian; but possibly it holds universally. The clearest fact in this connection is that nominals, in contrast with verbs, never take their arguments obligatorily. This is illustrated by the following contrasts:

(9)   a. * donated   a'. the donation
      b. *John donated   b'. John's donation
      c. * John donated to the library   c'. John's donation to the library
      d. John donated a rare book to   d'. John's donation of a rare book
         the library   to the library

The constructions to the left in (9a-c), involving verbs, are not well formed, while those on the right (involving nouns) are. Again, here too there are many accounts available. One way of thinking about what is going on is that derived nominals are simply predicates of eventualities and have representations of the following sort:

(10) a. DONATION(e)[to be read as "event e is a donation"]
      b. EXPLOSION(e)
      c. ATTACK(e)

Such nouns are derived by closing off existentially the arguments of the verb. To be reactivated such arguments need special constructions (e.g. prepositions of the right sort, or the genitive). It's as if in nominals the argument structure of the verb, while in a sense still there, is somehow de-emphasized. Be that as it may, it is a fact that nouns can be used without their arguments, while verbs typically cannot. More specifically the capacity to project arguments does not seem to be a prerequisite to the use of nouns in the way it seems to be to the use of verbs. Thus something affecting specifically argument structure may leave even deverbal nouns intact. Clearly there is something to test here. We need to test how V/N dissociations impact on closely related pairs involving verbs and the corresponding event-nominals, as that will be informative both for the study of the pathology and as a testing ground for grammatical hypotheses.

Summing up, under the hypothesis that language pathologies may directly affect argument (or thematic) structure we seem to come to an understanding of why imageability may play an important role in the performance of aphasics with N superiority, while no comparably strong effect is found in patients with V superiority. First, damage to argument structure will affect directly only verbs (as nouns either don't have argument structure or, roughly put, they can be used also without it). Hence, damage to argument structure will give raise to a selective impairment on verbs. Second, imageability's function is that of helping extracting the protagonists from the perceptual/conceptual coding of a dynamic eventuality. As there is a natural mapping from these to the structure of lexical entries, the more imaginable the eventuality, the more performance with verbs will be enhanced (and the damage compensated for).

How does our hypothesis of a grammatical deficit centered on argument structure fare vis-a-vis other hypotheses concerning impairments in verb use, like Friedmann's idea that it is the tense system that might actually get damaged? Generally speaking, such hypotheses are consistent with each other, in the sense that both aspects of grammar might conceivably be independently impaired. It is however unclear to us how Friedmann's hypothesis by itself could account for the imageability effect we found. For one thing, we don't know whether our subjects are producing (fragments of) sentences or words. Friedmann's hypothesis would seem to be relevant only in the

former case. Moreover, Friedmann's account is offered only for agrammatic patients; but there are also fluent patients who show the same pattern of impairment. Finally, recall that her idea is that syntactic structure gets truncated right above the functional category dominated by the tense node. This prevents (tensed) verbs from rising to the appropriate position to check their morphological features, and hence use of verbs is hampered. As she points out, however, truncation of (high) functional structure does not generally prevent untensed (e.g. infinitival) verbs from staying within the VP (or climbing to a 'low' functional category) and assigning their theta roles in the usual manner. If imageability affects argument structure, it shouldn't have a particularly strong affect according to Friedmann's account. So agrammatic patients should not, it would seem, be subject to strong imageability effects, in so far as we can make out. With respect to our sample, the symptomatology compatible with her conjecture is that of N-superiority patients that are not significantly affected by imageability.

But couldn't imageability be connected to the particular grammatical meanings of tense, aspect or actionality? For example, in much recent work it has been proposed that the inflectional layer of the verb is structured in a series of nested functional heads, which include information pertaining to 'actionality' (e.g. telicity vs. atelicicty), aspectuality (e.g. perfectivity vs. imperfectivity) and temporal location (e. g. present vs. past). The verb raises through this series of functional heads, thereby incorporating the morphemes that code such information. Under such a view the lexical verbal head is largely underspecified while a significant part of information is coded in the functional layer, so much so that its semantic richness may eventually explain why more imaginable verbs are easier to retrieve in verb impaired subjects. While this view deserves a closer look, we do not think, at present, that it offers many chances of success, for the following reasons. Consider the case of actionality. Visualize a particular event like, for example, the earth revolving around the sun. You can describe it as "the earth is revolving around the sun" (which is an atelic event or, in Vendler's famous terminology, a process). Or you can describe it as "the earth is completing a revolution around the sun" (which is a telic event, i.e. an accomplishment in Vendler's terms). Or you can even describe it as "the earth is in orbit around the sun", which is, in fact, a state. The same goes for aspect proper. As is well known, one and the same event can be described as culminating or as in progress, depending on whether we put it in the perfective or in the imperfective aspect. Ditto for tense: a past event can

be put in the present tense depending on the narrative dynamics. So, the inherent imageability of an event seems to have no bearing on the information typically coded in temporal and aspectual features (i.e. in the functional layer associated with the category V). Hence, if these features are the sole or the main locus of a selective damage, as on Friedmann's hypothesis, one doesn't see why verbs associated with inherently more imaginable eventualities should be easier to restore.

3.2. Effects of different kinds of argument structure

A second major family of effects that we found, related to argument structure, concerns the correlation of aphasia types and verb classes (transitive, unaccusative and unergative). With regard to transitives, we found they are selectively impaired in agrammatic patients (vis-a-vis monoargumental verbs). This effect (which must be taken with particular care, given the relative small sample of items submitted to our subjects) is perhaps not so surprising. If something hits argument structure it is to be expected that more complex ones will create more difficulties than simpler ones. Our results are in agreement with those obtained by Thompson et al. (1997) and only partly in agreement with other findings. In particular, Jonkers (2000) reports on a picture naming experiment similar to ours with Broca's aphasics, in which, however, patients were instructed to reply in two modalities: with words in isolation and with sentences. He found that Broca's aphasics at the word level were uniformly better with transitive verbs than with intransitives; at the sentence level, instead, they split into two subgroups. One subgroup was better with intransitive verbs, the other with transitives. He argues that the greater ease with transitives found at the word level is a word frequency effect (transitives being more frequently used in spontaneous speech than intransitives). The difficulty found (in one group) at the sentence level is instead due, according to him, to the increased load on the processor that stems from sentences with transitive verbs. In general, we did not find better performance with transitives. Most of our aphasia groups (namely, Wernicke's, anomics and non agrammatic nonfluent ones) seemed to behave (*mutatis mutandis*) similarly to the normal control, with respect to how they handled transitive verbs relatively to other verb types. Agrammatics showed, instead, a particular difficulty with transitives, significant in comparison to Wernicke's. Part of this may be due to the fact that some of them were implicitly trying to construct sentences. This

would be in accord with Jonkers's findings. But it is unlikely that what we found can be wholly explained in these terms (for some of them might well, instead, have been trying to give single words). This issue evidently calls for further experimentation.

Particularly interesting is the behavior of unaccusative verbs (a result that has never been reported on so far). In virtually all types of aphasic (except anomic) patients, unaccusative verbs appear to create significantly more difficulties than intransitive (unergative) verbs. This is particularly evident in Broca's patients. A simple complexity measure that merely counts number of arguments does not lead one to expect this effect. There are several possible explanations that might be entertained, all of which call for further experimentation. If action naming involves building (reduced) clauses, the difficulty might be syntactic in nature, due to the necessity to move the internal argument of the unaccusative verb into the canonical subject structure. Accordingly, these subjects ought to display analogous difficulties with other kinds of NP movement (i.e. passive and raising) which seems to be the case (cf., e.g. Grodzinsky 2000). One might object, however, that NP movement with unaccusatives is often optional. For example, in Italian the subject of unaccusatives may be left in its original postverbal site. If there is no movement, there are no traces, and hence the difficulty that aphasic patients seem to encounter with unaccusatives cannot be blamed on any difficulty related to traces. However, there are other factors that may well play a role. When the argument of unaccusatives is left in situ (as in *è arrivato Leo* 'has (lit. *is*) arrived Leo'), it is generally assumed that the subject position is filled by a null expletive element (i. e. a silent counterpart of English 'it'). Now aphasic and, in particular, agrammatic patients are known to loose various aspects of functional structure. Perhaps, the difficulty with unaccusatives is linked to a more basic difficulty with expletive elements. Aphasic patients may loose the ability to insert expletive elements in the appropriate required positions and hence sentences with unaccusatives cannot be generated. If this is so, the relevant subjects ought to have difficulties with other kind of constructions requiring expletives (like weather verbs, and extraposed or inverted subjects).

It is a bit trickier to imagine what might go wrong with unaccusatives for subjects that are not trying to build up sentences, but simply uttering words in quotation form, which ought to involve merely the lexical representation of words. Clearly unaccusativity must be lexically coded. Somehow the lexical entry must contain the information that relevant verb lacks an external argument. Accord-

ing to some (cf. e.g. Bresnan 1982 for an early formulation) the relevant information might be deduced from the fact that these verbs lack an agent (i.e. they wind up with a non agentive subject). This idea has been challenged, to our mind successfully, by much of the subsequent literature (see e.g. Rosen 1984). According to others (e.g. Van Valin 1987), it is the Aktionsart of the verb (in particular, its telicity) the predictor. But this too is highly controversial (though there certainly is a strong link between unaccusativity and actionality of the verb). Be that as it may, it remains to be seen why exactly the lexical entry (the lemma) of unaccusatives ought be somehow more complex than that of unergative intransitive. It is as if having an external argument, makes the verb more 'visible' and less amenable to undergo damage in argument structure. The lack of an external argument is a property unaccusative share with raising verbs (like *seem*). Hence these types of verb too ought to cause problems. This prediction won't be straightforward to test by our procedures as raising verbs like *seem* are psychological verbs, virtually impossible to represent pictorially.

It may be worth noticing that a selective damage to specific subcategories of verbs is clearly inconsistent with the hypothesis of a *total* loss of their argument structure (for that would imply a loss of capacity of differentiating such subclasses from each other). What we are proposing, however, is either a partial damage to argument structure or to its processing. So, for example, mapping a more complex argument structure onto a syntactic tree requires more processing resources. Analogously, if the structure is richer, retrieving the appropriate argument structure from a visually presented event (which is how we understand the imageability effect) will be harder.

Taking stock, the effect we found with unaccusatives, if confirmed through further experimentation is particularly interesting. It is generally consistent with our main hypothesis, viz. that argument structure is one of the aspects of verb representation, which is most likely to get damaged in N superiority patients; but it is also consistent with a variety of more syntactic accounts. Further work is needed to sort the relevant issues out.

3.3. *Word frequency effects on V>N patients*

A further major effect we found concerns patients with V-superiority. While imageability has essentially no effect on them, word frequency does. I.e. the performance of noun impaired patients tends to improve as nouns become more frequent. As with N-superiority, how-

ever, not all cases of V-superiority disappear once word frequency is factored out. This suggests that also V-superiority probably is ultimately due to some grammar specific deficit selectively affecting the mental representation of nouns. The question is why frequency matters in such a case.

To address this question, we should have a better grasp of the forms that a selective impairment of nouns may take. As noted above, argument structure of nouns is either absent or is represented in such a way as not to constitute a prerequisite to their use. Hence damage to argument structure should leave nouns unaffected. A damage that selectively affects nouns should concern some morphosyntactic property specific to them. For example, within parametric and minimalistic frameworks, nouns must get structural case; if the capacity to check nouns for structural case gets impaired use of nouns would be compromised. Also conceivable is that something in the semantic representation of nouns gets damaged. For example, nouns are semantically associated with sorts or kinds of objects (viewed as a specifically linguistic category – see, e.g. Carlson 1977). If the capacity to refer to kinds is somehow impaired, use of nouns would become more difficult than use of verbs (that do not involve kind reference).

Further possibilities are certainly conceivable. At this point we have no less speculative considerations to offer. Be that as it may, the central point is the following. If something specifically damages the category N (or something uniquely associated with it) as such, what could partially compensate for such a damage? What could enhance performance, in such a case? Recall that in our experiment we are dealing primarily with nouns of various kinds of natural objects or artifacts. Their linguistic structure is, in a sense, simpler than that of verbs. Such nouns don't require arguments and generally rank higher in terms of imageability. Actually, it is intuitively clear that the mental images associated with them must actually be qualitatively different from that associated with verbs. In the case of verbs, we are dealing (in our sample) with dynamic actions; in the case of names with static objects. The low impact of imageability on nouns can be presumably traced to these differences. The relative differences in imageability among nouns of the sort we tested is just too minimal to have an impact. In naming the picture of an action some decoding is necessary as we are not seeing the whole action. No such difficulty arises in naming an object. Hence the only factors that are left to play a role are plausibly (i) word frequency and (ii) the underlying perceptual and or conceptual knowledge associated with nouns. The

role of (i) is obvious: the more frequent a noun, the easier it will be to restore the corresponding lexical entry. Concerning, instead (ii), as with verbs, nouns are presumably linked to their referents through some cognitive schemata (i.e. images, prototypes, functional knowledge, etc.). Depending on the nature of such damage (i.e. whether it is more sensory or more functional/conceptual), different categories of nouns may be affected (as suggested by Warrington & Shallice, 1984).

So, in presence of a damage specific to nouns, imageability is not expected to play a visible role, as nouns rank high on this score. This leaves word frequency as well as kinds of knowledge linking nouns to their referents (sensory vs. functional) as factors possibly determining word retrieval.

4. Conclusions

Our results lead us to conclude that V-N dissociations cannot be wholly reduced to (i.e. explained by) problems with extralinguistic aspects of our sensory/conceptual system. One cannot go from purely sensory/conceptual deficits to an understanding of why a certain grammatical category is relatively spared with respect to the other. The crucial damage has to be located, it would seem, at a specifically grammatical level of representation. More specifically, in presence of a damage to argument structure, verbs are going to be selectively affected. If this is so, the easier it is for an action to be coded in mental visual images the easier it might be to restore the corresponding argument structure (by extracting from the events its protagonists) and hence to somehow retrieve or rebuild the relevant linguistic representation. In case of a selective damage to nouns (that lack an argument structure in the relevant sense) no similar effect is expected. Word frequency and kind of knowledge that links nouns to their referents (sensory vs. functional) are thus the remaining factors that can facilitate the task of retrieving the corresponding linguistic representations. This hypothesis requires further testing (e. g. with deverbal nominals). Moreover, it should be kept in mind that several sources of damage may occur and interact with each other. For example, we do not think that damage to argument structure is necessarily the *only* source of verb deficit. Other kinds of damage (e.g. lexical damages to the category V, or damage to *specific* argument structure – like unaccusative, or damage to the functional layer of verbs – a la Friedmann) are clearly conceivable and, in fact, can coexist across different types of aphasia. What comes out of our study (with its lim-

its due to our use of a single naming task with a relatively large sample of aphasics) is that (for verbs) direct or indirect damage to argument structure may provide us with an account that covers the largest number of cases. Be that as it may, the categorial status of the V-N distinction (as well as its rich interaction with extra grammatical modules) appears to be well supported by our data on language pathology.

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Footnotes

[1]   Thompson and coworkers (Thompson, Lange, Schneider & Shapiro, 1997) found that verbs taking *more* arguments are *harder* for agrammatic patients to produce, *even when retrieved as single words*. Jonkers (2000) found that Broca's aphasic patients could name transitive verbs better than intransitive verbs. However, this difference could not be generalized to all Broca's patients and also emerged on fluent aphasic patients. The superiority of transitive verbs found by Jonkers is consistent with the results reported by Davidoff and Masterson (1996) who found that transitive Verbs are acquired earlier than intransitive verbs. However, De Bleser (2000) found the opposite difference both in language acquisition and in Broca's patients. Intransitive verbs are acquired earlier and are less impaired.

[2]   However, Berndt et al. (1997), using static and dynamic stimuli did, not find different rates of performance across tasks.

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