

# THE CRUCIAL ROLE OF THE EVENT STRUCTURE IN THE RETRIEVAL OF NOMINALIZATIONS IN APHASIA

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**Abstract:** *In the aphasic production, the verb-noun (V-N) dissociation (a condition whereby brain damage selectively affects one of the two categories, while sparing the other) may have a different nature in different cases, reflecting semantic, syntactic or grammatical class effects. The observation that the V-N dissociations have a different nature goes in hand with the fact that in Linguistics it is hard to spot out the differences between nouns and verbs in a clear-cut way. In this regard, the nominalization phenomenon is explicative since nominalizations share both nominal and verbal properties. In the literature on aphasia, only few have studies tested how verbal and nominal selective deficits impact on closely related pairs involving verbs and the corresponding nominalizations. The present study aims at verifying whether the aphasic production of nominalizations can be affected by class selective impairments or by semantic/syntactic deficits. It will be showed that the aphasic speakers' errors enlighten the crucial role played by the event structure, the Aktionsart and the grammatical aspect in the retrieval of the nominalizations. Such conclusions provide neurolinguistic evidence in favour of the idea that some features and properties can cross the boundaries of the verb-noun class distinction.*

**Keywords:** *nominalization, aphasia, verb-noun dissociation, aspect, event structure*

## *1. Introduction*

### *1.1 Verbs and Nouns in Linguistics*

In Linguistics the nature of verbs and nouns has been long debated and this concern is still crucial for many modern linguistic approaches such as the Generative framework. That nouns and verbs consist of two distinct well-cut classes is a quite common thought dating back at least from Dionysius Thrax's grammar (c. 100 BC) and Vico's and Condillac's works in the 16<sup>th</sup> century, just to mention a few. If it is out of question that in human languages some words behave as nouns and others as verbs, nonetheless a clear definition of these two lexical categories is far from being achieved. Prototypically, nouns have referential functions and denote objects while verbs have predicative functions, take

arguments and denote events. However, some words hardly fit in one of these two definitions. For example, nominalizations have the same syntactic distribution of a noun, but can denote events and take arguments as verbs (1).

- (1) Colombo's discovery of America was in 1492.

The nominalization puzzle can be taken as a piece of evidence for arguing in favour of the idea that nouns and verbs are not really two polar entities. In this sense, the paper on category squish by John Ross in 1972 laid the basis for an analysis of verbs and nouns in terms of a *gradatum*. He took into account a number of linguistic facts pointing out that the distinction between verbs and nouns (and adjectives as well) is not a discrete one, but is spread in a "category space" as illustrated below:

- (2) verb > present participle > perfect participle > passive participle > adjective > preposition > adjectival noun > noun

Prototypical nouns and prototypical verbs are set at the opposite edges of this category space, while in the middle some mixed categories are listed. More relevant for the purposes of the present work, in 1973 Ross elaborated the following "nouniness scale":

- (3) a. That clauses: John said [that Bill gave Mary a book]  
b. For to clauses: He would resent (it) [for me to go out with Mary]  
c. Embedded questions: I wonder [how long time I have to wait here]  
d. Acc-ing (complements): He resented [me going out with Mary]  
e. Poss-ing (complements): He resented [my going out with Mary]  
f. ing-of (Action nominals): He resented [my careless examining of the body]  
g. Derived nominals: He resented [my careless examination of the body]  
h. Underived nominals: He resented [the daughter of Bill]

The idea that noun and verb are not atoms, i.e., primitive entities, has been formalized in different ways (Borer 2005; Clark & Clark 1979; Marantz 1997 and following works). In particular, the Distributed Morphology approach (Alexiadou 2001; Marantz 1997) posits that syntax creates complex objects out of two different types of morphemes, roots and functional morphemes. Roots are assumed to be category-neutral and they are categorized in syntactic structures by functional heads such as *v* and *n* in order to yield verbs and nouns. On this account, there would be two scales: a verbal one (occurrence of nominative and accusative cases, modal and auxiliaries, morphological aspect and argument structure) and a nominal one (occurrence of determiners, gender and plural markers, genitive case). If the two scales can interact with one another it follows that the distinction between verbs and nouns is not polar, but gradual in nature since the verb-noun cut-off point can be set at various levels.



already mentioned, nominalizations, for example, are substantives referring to a verbal predicate and sharing some verbal properties.

At the end, all the hypotheses concerning an assumed greater verbal complexity have to face with a cognitive issue and a linguistic one, however. Firstly, if verbs processing is more demanding than nouns processing, the selective nominal deficits reported in the literature (Berndt et al. 2002; Caramazza & Hillis 1991; Damasio & Tranel 1993; Menichelli & Semenza 2006; Miceli et al. 1999; Zingeser & Berndt 1990) remain unexplained. Secondly, it is not clear where the linguistic boundary between verbs and nouns has to be set. In this respect, it would be interesting to test not only prototypical nouns and verbs, but also hybrid phenomena as compounds (see Semenza & Mondini 2010 on this issue) and nominalizations.

More recently, cognitive neuropsychologists agree that nouns and verbs are represented and processed by means of different functional as well as anatomical ways. In this respect, it becomes crucial to understand which linguistic levels are relevant for the functional organization of the mental lexicon. Some studies have argued that the organization of the mental lexicon would reflect a grammatical class effect (Badecker & Caramazza 1991; Caramazza & Hillis 1991; Rapp & Caramazza 2002; Shapiro & Caramazza 2003; Shapiro, Moo & Caramazza 2006). If this were true, patients with selective verbal deficits would not exhibit problems with nouns describing events, that is nominalizations. A study conducted by Collina, Marangolo & Tabossi (2001), reported below, seems to invalidate this conclusion. In addition, a study by Menichelli & Semenza (2006) conducted on an amnesic patient, reported nominal selective impairment that cannot be explained in terms of a grammatical class deficit nor in terms of a semantic deficit. In this sense, these findings are problematic for those hypotheses based on a semantic perspective as well. According to these hypotheses (Bird, Franklin & Howard 2000, 2003; Mätzig et al. 2009), the functional organization of the lexicon would be semantic in nature and would reflect the prototypical meaning of nouns and verbs. On the one hand, verbs would mainly refer to actions and would be less imaginable; on the other, nouns would mainly denote objects and would be more imaginable. As a consequence, the V-N dissociation would not reflect a grammatical class effect, but it would be a by-product of the imageability feature. If the nouns and the verbs of a task are matched for this variable, the V-N dissociation will be not observable anymore. This hypothesis, though, is not much fine-grained from a linguistic point of view. It is not true that generally verbs describe actions; in fact, some verbs describe states as well and in these cases they show nominal and adjectival properties (Vendler 1967). Moreover, nouns can depict not only objects, but even abstract entities or events, as nominalizations do. In support of this linguistic analysis, some neurolinguistic studies have reported cases of V-N dissociations even if the items of the administered tests had been matched for imageability. In particular, Luzzatti and coworkers (2002) noted that the V-N dissociation was still observable in one third of the cases after ruling out the imageability effect. They noted that imageability mainly affects verbs retrieval while frequency mainly affects nouns retrieval. Luzzatti & Chierchia (2002) have argued that these findings cannot be a mere consequence of an imageability effect, but depend on the fact that retrieving a verb is a qualitative different task from retrieving a noun (see also: Chiarello, Shears & Lund 1999). Luzzatti et al.'s (2002) work suggests that the V-N dissociations described in the literature may be determined by the interplay of different variables in the mental organization of the lexicon.

### 1.3 The nominalization puzzle

Thus it seems that the V-N dissociations reported after brain damage may have different a nature in different cases. In turn, this supposition goes in hand with the fact that in Linguistics it is hard to spot out the differences between nouns and verbs in a clear-cut way. Many variables and linguistic levels are involved in the definition of such categories and the set of nouns and the set of verbs change their elements depending on the variable and on the level considered.

In this sense, derived nominalizations (DNs) are explicative, since they share both nominal and verbal properties (Alexiadou 2001; Chomsky 1970; Grimshaw 1990; Marantz 1997). As already mentioned, from a morphosyntactic point of view, they are nominal elements since they have the same syntactic distribution of the nouns and, at least in Italian, they take prepositional complements. From a semantic point of view, though, they are verb-like since they can denote events and can be associated with a thematic and argument structure. In (5) the noun *giacca* ‘jacket’ takes a prepositional complement, ‘*di Simone*’ ‘Simone’s’, that can indicate the owner of the jacket, the person who created that jacket, a person who likes that jacket, etc. On the contrary, in (5b) the DN *mangiata* ‘eating’ takes the same prepositional complement, *di Simone*, that can indicate only the entity ‘x’ of the event ‘x eats y’. The relations between a nominalizations and its complements are less ambiguous than those between a noun and its complements because a nominalization assigns the same thematic and argument roles that the corresponding verb (‘to eat’) would assign.

- (5) a. *La giacca di Simone*  
      ‘Simone’s jacket’  
      b. *La mangiata di Simone*  
      ‘Simone’s eating’

However, at a first glance, there seem to be some differences between verbal arguments and nominal arguments. A verb assigns nominative and accusative case in such a way that its arguments are always be recognizable as agents, causes, themes, etc. For instance, in (6a) it is not possible to interpret the constituent ‘Romans’ as the agent of the event ‘destroy’. In other words, verbal heads are associated to an argument structure that must be always satisfied otherwise the sentence will be ungrammatical (6b).

- (6) a. Barbarians destroyed Romans.  
      b. \*Destroyed.

Moreover, since a sentence must be always interpreted as the union of a subject and a predicate, it follows that the syntactic subject of a sentence must be always realized, in agreement with the EPP (Extended Projection Principle). Throughout the literature it has been noted that, differently from verbs, nominalizations have not to obligatorily carry out their arguments. In (7a) there are no arguments and the phrase is grammatical. It could be speculated, though, that in (7a) the DN takes null arguments in a parallel way an inflected verb can take null subject and null object in a pro-drop language (as Italian). Besides this, it remains the fact that, differently from verb arguments, if one of the DN arguments is omitted, the interpretation of the remaining one is ambiguous, at least in Italian. In (7c) it is

no longer possible to decide if the noun ‘barbarians’ is the agent or the theme of the event ‘destroy’.

- (7) a. *La distruzione*  
‘The destruction’  
b. *La distruzione dei Romani da parte dei barbari*  
‘Barbarians’ destruction of Romans’  
c. *La distruzione dei barbari*  
‘The destruction of Barbarians’

Interestingly, In Italian there is a particular kind of nominalization, called infinito sostantivato (IS; see Zucchi 1993), that permits an unambiguous interpretation of the cases illustrated in (7c). The IS is an infinitive that have the same distribution of a noun, can be modified by a determinant and by an adjective. Differently from DNs, the IS is applicable to all verbal routes (productivity), cannot be pluralized, can assign accusative case (and sometimes nominative case as well), can be modified by adverbs, auxiliaries, modals, can be turned into passive and can be negated. Briefly, IS shows a more verb-like syntax with respect to DNs. In a certain sense, IS is similar to English *-ing* nominals.

- (8) *Il distruggere case da parte dei vandali.*  
‘Vandal’s destroying houses.’

Given these peculiarities, it becomes clear the reason why DNs and IS can be informative for the study of the V-N dissociations and the linguistic pathologies in general. The phenomenon of the nominalization is the prism through which the nature of the V-N dissociation can be observed. Selective deficits and problems with the nominalizations can be explained as the consequence of three possible effects: (i) event vs. non-event; (ii) obligatory realization of the arguments vs. optional realization of the argument; (iii) noun syntax vs. verb syntax. In a first case the V-N dissociation would be of a conceptual-semantic nature. In this condition, both verbal selective deficits and problems with nominalizations should be observable. In a second case, the deficit would involve the semantic-syntactic interface and patients with verbal selective damage should do well with nominalizations. In a third case, the deficit would be syntactic in nature and verbal selective problems would display a specific kind of nominalization showing a more verbal syntax, that is, IS in Italian.

Moreover, if patients suffering selective nominal deficits do bad with DNs and patients suffering selective verbal deficits do well with DNs, it will be the case for an analysis of verbs and nouns as two distinct well-cut classes. On the contrary, if patients suffering selective verbal deficits do bad with DNs or at least with particular kinds of nominalizations, it should be the case that there exist some features and properties that cross the boundaries of the class distinction.

### 1.3.1 Nominalizations in aphasia

Despite the great amount of studies devoted to the analysis of the V-N dissociations in aphasia, only in few cases (Collina, Marangolo & Tabossi 2001; Crepaldi et al. 2006; Siri et

al. 2008) tests have been designed to verify how verbal and nominal selective deficits impact on closely related pairs involving verbs and the corresponding nominalizations.

The study by Collina and co-workers is one of the first studies on the production of nominalizations in aphasia and it has the merit of testing the DNs production in order to have a better comprehension of the V-N dissociation nature. The authors administered a picture naming task in which the target items were made up of simple nouns, DNs, one-argument and two-arguments verbs. The three Italian aphasic patients tested did better (i) in the production of nouns than verbs; (ii) in the production of nouns than DNs and (iii) in the production of one-argument verbs than two-arguments verbs. According to the authors, these results would be in agreement with the argument complexity hypothesis (i.a.: Thompson 2003). The V-N dissociations would not be due to an imageability effect or to a grammatical class effect, but to a statistic effect according to which verbs and not nouns are generally associated to an argument structure. The production of the three patients tested would show that the complexity argument effect would take place at both verbal and nominal level.

However, some remarks can be moved. A first doubt concerns the item of the tasks. It is not clear why DNs like *scontro* ‘crash’ and *divisione* ‘division’ were listed with the simple nouns. As for the verbs lists, a reason cannot be easily found for having considered one-argument verbs causative verbs as *bollire* ‘to boil’ and transitive verbs as *giurare* ‘to swear’, *stirare* ‘to iron’ and *suonare* ‘to play’. As far as the DNs list is concerned, some targets cannot phonologically express their arguments, at least in Italian (*\*il pattinaggio/nuoto di Gianni*, lit. ‘the skating/swimming of John’). If the aim of the study is to compare the production of verbs and nouns on the basis of the argument structure it seems natural considering only those DNs that clearly take arguments. Moreover, the DNs targets do not reflect the complexity of the nominalization phenomenon in Italian. In fact, the nouns derived by highly productive nominalization processes were excluded, that is, the DNs ended in *-mento*, *-zione*, *-(a)ta* and the IS.

Secondly, the analysis of errors is sometimes obscure. The authors claim that the errors are due to a syntactic deficit and not to a loss of semantic information, but their argumentation is not completely convincing. For instance, semantic paraphasia as *pugnalare* ‘to stab’ > *uccidere* ‘to kill’ seems depending on the kind of the picture showed during the test or on a lexical impairment, but not on a syntactic deficit. In fact, a syntactic deficit would have caused a shift even as far as the argument structure of the target is concerned (i.e. *pugnalare*: two-arguments verb > *morire* ‘to die’: one-argument verb). A similar objection can be moved as for the analysis of the DNs production. Inexplicably, paraphasic productions such as *pugnalata* ‘stab’ > *uccisione* ‘killing’, *scoperta* ‘discovery’ > *sorpresa* ‘surprise’, *sparatoria* ‘shooting’ > *litigio* ‘quarrel’ have been considered syntactic and not semantic or lexical errors. It is worth noticing that these answers counted as errors are DNs that can phonologically take arguments.

In brief, Collina and co-workers’ study has undoubtedly the merit of first testing the DNs production in aphasia, but for the moment there is not enough evidence to agree with the authors’ conclusions, that is, with the claim that patients’ difficulties in naming the DNs would reflect an argument complexity effect and a syntactic deficit. The main remark on Collina, Marangolo & Tabossi’s work concerns the fact that the authors did not face with the question of the comparability between the argument structure of a verb and that of a noun. As already illustrated, a verb must obligatorily carry out its arguments while a DN does not. The focus is not only on the possibility for some constituents (and not for others)

to have an argument structure, but also on the way that this possibility is given at the semantic-syntactic interface. Does this difference play a role in our mind/brain?

In the next section a neuropsychological study conducted on three Italian aphasic speakers will be described. This study aims at testing whether the production of nominalizations can be affected by verbal selective impairments, argument complexity, and the kind of syntax that nominalizations display, noun syntax (DNs) vs. verb syntax (ISs).

## 2. *The neurolinguistic study*

### 2.1 *Participants*

Three Italian aphasic patients (ED, LI and ZA) and three control subjects took part to this study. The control subjects matched the aphasic patients as for age and education. Both patients and control subjects were born in Veneto, in the North-East of Italy. The patients were selected by the speech-therapists of Clinica Neurologica I, Padua and IRCCS Ospedale San Camillo, Venice.

At the time of test administration, ED was a 76-years-old right-handed retired bank clerk with eight years of education. His L1 was Italian as spoken in the North-East areas near Padua. He suffered a vascular accident in the left frontal lobe. His aphasia was accompanied by dysgraphia, dyslexia and bucco-facial apraxia, but not by constructional and ideomotor apraxia. The AAT (Aachener Aphasia Test, Italian version) lead to a diagnosis of non-fluent Broca's aphasia. The BADA (*Batteria per l'analisi dei deficit afasici*) revealed a V-N dissociation, verbs being significantly more impaired than nouns (V: 5/28; N: 16/30<sup>1</sup>). The tasks of the present study were administered 15 months post-onset, where the verb-noun dissociation persisted. A screening test highlighted in ED's production some difficulties with the number morphology (singular: 15/20; plural: 15/20) and with verb argument structure. More precisely, ED performed well with the transitive verbs in their active form (12/12) and with the unergative verbs (10/10), while he performed worse with the unaccusative verbs (7/10) and the passive verbs both with realized by-phrase (0/9) and not realized by-phrase (1/9).

LI was a 36-years-old right-handed employee with 18 years of education. Her L1 was Italian as spoken in the North-East areas near Padua. She suffered a vascular lesion involving the left temporal lobe. The AAT lead to a diagnosis of a mild fluent Wernicke's aphasia. The BADA did not reveal a significant V-N dissociation (V: 15/28; N: 18/30). A screening test highlighted in LI's production no problems with morpho-syntactic features of the noun, but, unlike the other patients in this study, problems with verbal negation (12/20). On the other hand, LI performed relatively well with verb argument structure (transitive verbs in their active form: 12/12; unergative verbs: 10/10; unaccusative verbs: 10/10; passive verbs both with realized by-phrase: 8/9 and not realized by-phrase: 7/9).

ZA was a 61-year-old right-handed worker with 8 years of education. His L1 was Italian as spoken in the North-East areas near Belluno. He suffered a vascular accident in the left frontal lobe. The AAT lead to a diagnosis of a non-fluent Broca's aphasia. BADA's picture naming task highlighted a significant V-N dissociation, verbs being more impaired than nouns (V: 13/28; N: 25/30). The tasks of the present study were administered four months post-onset, where the verb-noun dissociation persisted. A screening test highlighted in ZA's

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<sup>1</sup> Here-hence all the results and the percentages reported indicate the *correct* production.

production some difficulties with the number morphology (singular: 13/18; plural: 17/17) and with verb argument structure. More precisely, ZA performed relatively well with the transitive verbs in their active form (6/12) while he performed worse with the unaccusative verbs (4/10) and the passive verbs both with realized by-phrase (1/9) and not realized by-phrase (0/9).

## 2.2 General methods

The items of the present study were presented one at a time, in both oral and written modality, in random order to minimize perseveration errors. The tasks were administered by the speech-therapists in different sessions, thus minimizing the effects of tiredness. Before each task participants were trained in order to make sure that they had well understood the assignment. They were required to answer orally and no time limits were set. Patients' answers were transcribed by the speech-therapists and tape recorded. Word frequency data were collected from Colfis (Bertinetto et al. 2005).

## 2.3 Task 1: the derived nominalizations (DNs) and the infinito sostantivato (IS)

*Hypothesis.* Consistently with their V-N dissociation, ED and ZA were expected to perform better with target DN's involving noun syntax than with target IS's ('the + infinitive'). In fact, as already illustrated (see section 1.3), IS's are a particular kind of nominalizations that involve verb syntax and can assign accusative case.

*Methods.* A completion task required to derive the target nominalization starting from a neutral verb form (infinitive form or 3rd singular, simple present in the case of target DN's and 3rd singular, simple present in the case of target IS's). Twenty targets involved DN's (noun syntax; 9a) and 20 targets involved IS's (verb syntax; 9b):

- (9) a. *La \_\_\_\_ di una bambola da parte dello zio*  
'the(-S.) \_\_\_\_ of a doll by the uncle'  
Input: to promise Target: (the) promise  
b. *Il \_\_ favori da parte del ministro*  
'the \_\_ favours by the minister'  
Input: promise-3rd s. Target: (the) promising

Target words could not be fully balanced for word frequency since DN's (mean frequency: 220) are marginally more frequent than IS's (mean frequency: 121). However the difference was not significant ( $t = 1.63, p < .11$ ).

*Results.* In this task, all the control subjects performed at ceiling with the exception of one who totalized 19/20 in the IS condition. The three patients' results are reported in (10) and a clear trend in favour of DN's (noun syntax) can be noted in each case.

(10)	DN's/noun syntax	IS's/verb syntax
	ED: 13/20 (65%)	ED: 2/20 (10%)
	ZA: 9/20 (45%)	ZA: 6/20 (30%)
	LI: 16/20 (80%)	LI: 12/20 (60%)

ED and ZA did clearly better with nominalizations involving noun syntax (13/20; 9/20) than with nominalizations involving verb syntax (2/20; 6/20;  $z = 3.233, p < .001$ ). As for

LI's performance, instead, the difference was not significant (16/20 vs. 12/20;  $z = 1.38$ ,  $p < .1$ ).

Errors were computed separately for each patient. Most errors consisted of substitutions, although ED committed four omissions. For both types, nominal targets were most frequently substituted with either a verb, or, less frequently, with a DN by both ED and ZA. Unexpectedly, because of the nature of ED and ZA's problems, most frequent substitutions consisted of a 3rd person singular present or past<sup>2</sup>, past participle<sup>3</sup>, and only rarely with a non-target DN<sup>4</sup>. In (11) ED and ZA's errors direction analysis is summarized:

(11)	DNs (noun syntax)	
	ED: substitutions with verb = 6/7	substitutions with noun = 1/7
	ZA: substitutions with verb = 11/11	substitutions with noun = 0/11
	ISs (verb syntax)	
	ED: substitutions with verb = 8/12	substitutions with noun = 4/12
	ZA: substitutions with verb = 9/14	substitutions with noun = 5/14

ED and ZA substituted 17 times out of 26 with a verb and 9 times out of 26 with a noun; the difference is significant ( $z = 2.219$ ,  $p < .02$ ). Substituting words tended to be less frequent with respect to the target for both patients, however the difference is not significant (ED:  $t = 1.86$ ,  $p < .07$ ; ZA:  $t = 1.87$ ,  $p < .07$ ).

Differently from ED and ZA, LI's substitutions differ with respect to the kind of nominalization involved. In the case of target DNs (noun syntax), her substitutions consisted of infinitive<sup>5</sup> and a compound<sup>6</sup>. In the case of target ISs (verb syntax), her substitutions consisted of gerundive<sup>7</sup>, present participle<sup>8</sup> and non-target DNs.

<sup>2</sup> Target: 'la SCOPERTA (DN) dell'America da parte di Colombo' ('Colombo's DISCOVERY of America') → patient's substitution: '\*la SCOPRÌ dell'America da parte di Colombo' ('Colombo's DISCOVERED of America'); Target: 'il DISTRUGGERE (IS) città da parte dei barbari' ('barbarians' DESTROYING cities') → patient's substitution: '\*il DISTRUSSE città da parte dei barbari' ('barbarians' DESTROYED cities').

<sup>3</sup> Target: 'il LAVAGGIO (DN) dell'auto da parte del meccanico' ('mechanic 's WASHING of the car') → patient's substitution: '\*il LAVATO dell'auto da parte del meccanico' ('mechanic's WASHED of the car'); Target: 'il RACCOGLIERE (IS) giochi da parte dell'UNICEF' ('UNICEF's COLLECTING toys') → patient's substitution: '\*il RACCOLTO giochi da parte dell'UNICEF' ('UNICEF's COLLECTED toys').

<sup>4</sup> Target: 'la CAMMINATA (DN) di Maria nel bosco' ('Maria's WALK in the wood') → patient's substitution: '\*la CAMMINO di Maria nel bosco' ('Maria's PATH in the wood').

<sup>5</sup> Target: 'la CORSA della mamma verso casa' ('mum's RUNNING home') → LI's substitution: 'la CORRERE della mamma verso casa' ('mum's RUN home').

<sup>6</sup> Target: 'il LAVAGGIO dell'auto da parte del meccanico' ('mechanic's WASHING of the car') → LI's substitution: '\*il LAVASCIUGA dell'auto da parte del meccanico' ('mechanic's WASH-DRY of the car').

<sup>7</sup> Target: 'il CATTURARE i ladri da parte della polizia' ('police's ARRESTING the thieves') → LI's substitution: '\*il CATTURANDO i ladri da parte della polizia' ('police's ARRESTING the thieves').

<sup>8</sup> Target: 'il COMBATTERE i giganti da parte di Ercole' ('Hercules' FIGHTING the giants') → LI's substitution: '\*il COMBATTENTE i giganti da parte di Ercole' ('Hercules' FIGHTER the giants').

*Interim discussion.* As expected, given their V-N dissociation, ED and ZA performed better with DNs involving noun syntax than with ISs involving verb syntax. These results are not due to a frequency effect; moreover, the patients showed a trend in substituting the targets with less frequent words. Thereby, a morphosyntactic deficit can be argued for both patients. Such a conclusion matches the predictions of those linguistic studies embracing a morphosyntactic approach to the nominalization puzzle (even if from slightly different perspective, see: Alexiadou 2001; Alexiadou, Iordachioaia & Schäfer 2011; Borer 2003; Chomsky 1970; Marantz 1997; Ramchand 2008). The crucial point is that nominalizations do not form an homogeneous category. Some nominalizations can assign accusative case and be modified by aspectual adverbs, modals and auxiliaries (as the Italian IS does) while others can take of-complements and be modified by adjectives (as the Italian DNs do). A possible account that seems to be in line with the results of the present study posits that such differences rely on the number and the type of verbal and nominal layers entering the nominalization structures. If a DP and a vP projections must be always postulated since the former is responsible for the presence of a determiner and the latter for the argument structure/Aktionsart properties, the occurrence of other projections is restricted to the particular kind of nominal considered. In terms of Alexiadou (2001) and following works, a nominalization to be more verb-like must project AspectP (which determines the morphological aspect) while a nominalization to be more noun-like must project ClassP and eventually NumberP (which respectively determine the mass/count properties and the morphological number).

- (12) a. [DP ([NumberP [ClassP [nP [VoiceP [vP] [Root  
 b. [DP [AspectP [VoiceP [vP [Root (from Alexiadou 2010b)

If ED and ZA's relatively better performance with noun-like nominalizations was somehow expected, their substitution errors were not. Both patients significantly substituted a target nominalization with the correspondent fully inflected verb, frequently a past tensed verb. This is a surprising result since in the literature (Bürchert et al. 2005; Friedmann & Grodzinsky 1997; Yarabay Duman & Bastiaanse 2009) it is well known that aphasic people (especially agrammatic people) find it difficult to produce past tensed verbs.

It could be argued that this kind of substitutions is a consequence of the lack of a full verb in the stimulus. A further task was developed in order to compare the production of nominalizations in phrase (DP) context with the production of DNs and ISs in full sentence context. This task was given following the same methodologies and using the same targets of the previous one. The only difference consisted in having given a full sentence, and not a phrase, as stimulus. Targets consisted of 24 DNs (13a) and 12 ISs (13b):

- (13) a. *La \_\_\_ dell'America fu nel 1492*  
 'The \_\_\_ of America was in the 1492'  
 Input: discover-3rd s. Target: discovery  
 b. *(Il) \_\_\_ i pranzi fa male alla salute*  
 '(The) \_\_\_ the meal is not healthy '  
 Input: skip-3rd s. Target: skipping

No significant difference was found (ZA: tot:  $z = 1.001$ ,  $p < .3$ ; DNs:  $z = 0.137$ ,  $p < .8$ ; ISs:  $z = 1.58$ ,  $p < .1$ ; LI: tot:  $z = 1.167$ ,  $p < .2$ ; DNs:  $z = 0.585$ ,  $p < .6$ ; ISs:  $z = 0.636$ ,  $p < .1$ ).

In addition, no significant difference in the kind of substitutions committed in the two tasks was found as well.

It could be further argued that patients' poor performance with ISs is a consequence of a general impairment on infinitive form as such. In order to verify this hypothesis, another task was given in which the patients had to complete the sentence stimulus with the infinitive form of the verb.

- (14) *Il nonno pensa di \_\_\_ la maratona*  
'Grandpa thinks of \_\_\_ the marathon'  
Input: run-3rd s. Target: running

ZA and LI scored respectively 13/14 and 14/14. Thus, ZA's failure with the production of ISs is not due to a general problem with the infinitive .

In the last section of this paper a possible explanation of ED and ZA's substitution errors will be given.

#### 2.4 Task 2: the argument effect (I)

In task 1 the two Broca's aphasic subjects (ED and ZA) scored better with those nominalizations involving noun syntax (DNs) than with nominalizations involving verb syntax (ISs). On the contrary, the fluent aphasic patient without V-N dissociation (LI) did not perform significantly better in one type with respect to the other. Another task was developed, therefore, in order to verify whether the patients' production of nominalizations is influenced non only at the syntactic level (i.e., noun syntax vs. verb syntax), but also at the semantic level (or, at least, at the semantic-syntactic interface), in particular as far as the number of the arguments involved is concerned. In this respect, it is worth noticing that, in the screening test, the patients' production of one-argument verbs was not better than the production of two-arguments verbs (see section 2.1) and that this result is not similar to Collina et al. (2001) findings (see section 1.3.1). ED did significantly better with two-arguments verbs ( $z = 2.042$ ;  $p < .04$ ), ZA performed the same with both types of verbs ( $z = 0.469$ ,  $p < .6$ ) and LI performed always at ceiling. However, the patients performed relatively better with those verbs that do not involve the movement of the object to the subject position. That is, they scored higher with transitive active verbs than with passive and unaccusative verbs (see section 2.1). In this sense, ED's and ZA's verb production seems to be affected at the morphosyntactic level (i.e., active vs. passive verbs) rather than at the semantic level (i.e., one-argument vs. two-argument verbs).

*Hypothesis.* If ED and ZA's problems merely concern the syntactic level, no significant difference between their production of DNs derived from one argument verbs and their production of DNs derived from two arguments verbs should be observable.

*Methods.* The patients were given a completion task in which they had to derive the required DN starting from a neutral verb form (infinitive). Forty targets consisted of DNs derived from two arguments verbs (15a) and 40 targets consisted of DNs derived from one argument verb (15b):

- (15) a. *La \_\_\_ dei ladri da parte della polizia*  
'The \_\_\_ of the thieves by the police'  
Input: to arrest Target: arrest  
b. *La \_\_\_ della zia per Londra*

‘The \_\_\_ of (the) aunt toward London’

Input: to depart Target: departure

*Results.* In this task the control subjects performed at ceiling. Patients’ results are reported in (16). As expected, no significant difference between the production of DNs derived from one argument verbs and the production of DNs derived from two arguments verbs is observable in ED and ZA’s performance (respectively:  $z = 0.709$ ,  $p < .4$  and  $z = 0.905$ ,  $p < .3$ ). As for LI’s performance, a trend is to be noted in the direction of DNs derived from one argument verbs, though, the difference is not significant ( $z = 1.071$ ,  $p < .2$ ).

- (16) DNs from two arguments verbs  
ED: 15/40  
ZA: 19/40  
LI: 29/40  
Dns from one argument verbs  
ED: 12/40  
ZA: 15/40  
LI: 33/40

Once again, the errors committed by the two patients with V-N dissociation are surprising. As in task 1, errors consisted of substitutions. For both types, DNs targets were most frequently substituted with a verb (3rd person singular present or past; past participle; infinitive) and only rarely with a non-target DN or other nominal elements. Instead, LI’s substitutions mainly consist of non-target DNs or infinitives.

*Interim discussion.* As expected, no significant difference between the production of DNs derived from one argument verbs and the production of DNs derived from two arguments verbs was observed in ED and ZA’s performance. This result, taken together with the scores obtained by the two Broca’s aphasic participants in task 1 (i.e. the production of noun-like nominalizations better than that of verb-like nominalizations) and in the screening test (i.e. no difference between the production of one argument verbs and two argument verbs), can be seen as an evidence for a morphosyntactic analysis of ED and ZA’s problems.

This result differs from Collina et al. (2001) findings since the three patients of their study performed better with one-argument verbs than with two-arguments verbs. This performance can be due to a different deficit, more semantic than syntactic in nature as the patients’ substitutions seem to indicate (see section 1.3.1). However, while Collina and co-workers reported an argument complexity effect for verbs production, they did not mention whether the same effect was involved in the DNs production as well, that is, they did not specify whether the patients performed better with DNs derived from one argument verbs than with those derived from two arguments verbs. This is not a trivial issue if one aims at demonstrating that the argument complexity effect plays a crucial role at both verbal and nominal level.

As for the present study, if ED and LI’s production of one argument verbs is compared with their production of DNs derived from one argument verbs the difference is significant (ED:  $z = 2.331$ ,  $p < .01$ ; LI:  $z = 1.991$ ,  $p < .04$ ). A similar finding is observable in the case

of two arguments verbs and DNs derived from two arguments verbs (ED:  $z = 3.801$ ,  $p < .0002$ ; LI:  $z = 2.046$ ,  $p < .04$ )<sup>9</sup>. At a first glance, the fact that the participants performed better with the verbs than with the nominalizations, i.e. nominal elements, would be hard to settle with their verbal selective deficit. This result cannot be ascribed to a greater morphological complexity of the DNs, as Collina and co-workers did regarding the performance of the participants at their study. In fact, in the present study, differently from Collina et al.'s study, both verbs and nominalizations had to be derived from a neutral form and, at the end, the participants were asked to produce the required target selecting the correct suffix for the input (an inflectional suffix in the case of verbs, a derivational suffix in the case of DNs). In this regard, it is worth stressing that the three subjects (especially ED and ZA) often substituted the target nominalization with a verb and this could support the observation that nominalizations were more demanding to produce than verbs in this task. Where does the difficulty rely on if the greater complexity of nominalizations with respect to verbs is not merely morphological? In the last section of this paper a possible explanation for the nominalization complexity will be briefly argued, in comparison with other neuropsychological studies.

### 2.5 Task 3: the argument effect (II)

*Hypothesis.* Even if from different perspectives, some linguistic theories (Alexiadou 2001; Alexiadou & Grimshaw 2008; Grimshaw 1990; Marantz 1997) claim that only DNs carrying out thematic roles denote events and, in this sense, are verb-like, while DNs not carrying out thematic roles do not denote events and behave as simple nouns. If this is correct, the two Broca's patients with the V-N dissociation were expected to do better with DNs not carrying out thematic roles, since these latter are supposed to be more noun-like.

*Methods.* The patients were given a completion task in which they had to derive the required DN starting from a neutral verb form (infinitive). Ten targets consisted of DNs carrying out thematic roles (17a) and ten targets consisted of DNs not carrying out thematic roles (17b):

- (17) a. *La \_\_\_ di Gianni in piscina*  
'The \_\_\_ of John in the swimming pool'  
Input: to swim Target: swim
- b. *Il \_\_\_ in piscina fa bene*  
'The \_\_\_ in the swimming pool is healthy'  
Input: to swim Target: swimming

Target words were balanced for frequency (DNs with thematic roles: mean frequency 101; DNs without thematic roles: mean frequency 171;  $t = 0.84$ ,  $p < .09$ ).

*Results.* Two of the three control subjects scored 9/10 with DNs realizing thematic roles and 10/10 in the other condition. The third control subject performed always at ceiling. Patients' results are reported in (18):

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<sup>9</sup> As for ZA's performance, the difference is not significant ( $z = 0.152$ ,  $p < .8$  and  $z = 0.146$ ,  $p < .8$ ). This can be due to the fact that ZA suffered a more severe grade of aphasia with respect to the other two patients. As a consequence, this result cannot be taken as evidence for the equivalence between the verb argument structure and the DNs argument structure. It seems more reasonable thinking that ZA found it difficult to perform in both conditions since his greater impairment.

(18) DNs [+ theta roles]	DNs [- theta roles]
ED: 5/10	ED: 2/10
ZA: 8/10	ZA: 3/10
LI: 9/10	LI: 6/10

Surprisingly, the two patients with the V-N dissociation (ED and ZA) did better with DNs carrying out thematic roles (verb-like) than DNs not carrying out thematic roles (noun-like). Taken together, ED and ZA's results are significant ( $z = 2.543$ ,  $p < .01$ ); however this effect is mainly due to ZA's score, while only a trend is observable in ED's performance. Interestingly, LI's score goes in the same direction of the other two patients' scores. A part of one omission by ED, even in this task all errors committed can be classified as substitutions consisting of past participle, infinitive, or another non-target DNs. Substituting words were found to be same frequent with respect to the target (ED:  $t = 1.65$ ,  $p < .1$ ; ZA:  $t = 0.04$ ,  $p < .9$ ).

*Interim discussion.* The patients' performance goes in the opposite direction with respect to that predicted by the hypothesis. Their results cannot be explained in terms of a target frequency effect nor in terms of an argument structure complexity effect. A possible reason can be seen in the provided input, that is, the neutral verb form from which the DNs had to be derived. More precisely, it is possible to argue that patients' performance may be influenced by the stimulus, that was a verb. Thus they might have preferred the event interpretation (since verbs describe events) rather than the non-event interpretation. As a consequence they did better with DNs carrying out thematic roles (that are verb-like since the occurrence of thematic roles is always linked to the event reading) than with DNs not carrying out thematic roles (noun-like according to some theories, as Grimshaw 1990).

Besides this, it could be argued that the occurrence of thematic roles does not constitute a necessary condition in order to interpret a nominalization as an event. In a more recent work, Alexiadou and Schäfer (2010) stress that "while complement structure builds on event structure, the presence of event structure does not necessarily imply the presence of complement structure". If it is the case, in what sense are the two types of nominalization different from each other? Following Borer (2005) and Mittwoch (2005), Alexiadou & Schäfer (2010) try to demonstrate that "rather the aspectual properties of the constructions are instrumental for the licensing of complement structure". In the next section the link between aspectual properties and complements licensing will be better illustrated since it represents a crucial point in order to make sense of subjects' performance and substitution errors.

## 2.6 General conclusions

Nominalizations represent a crucial test for the hypothesis on the nature of the V-N dissociations since they share both nominal and verbal properties at both the semantic and the syntactic level. However, despite the great amount of studies devoted to the analysis of the V-N dissociations in aphasia, only few studies (Collina, Marangolo & Tabossi 2001; Crepaldi et al. 2006; Siri et al. 2008) tested how verbal and nominal selective deficits impact on closely related pairs involving verbs and the corresponding nominalizations. The present study aimed at testing whether the production of nominalizations can be affected by verbal selective impairments, argument complexity, and the kind of syntax that the nominalizations display, noun syntax (DNs) vs. verb syntax (ISs).

Task 1 highlighted a syntactic effect in the two Broca's aphasic subjects' production of nominalizations. In fact, ED and ZA performed significantly better with nominalizations involving noun syntax than with nominalizations involving verb syntax. This result is compatible with both ED and ZA's kind of aphasia and V-N dissociation, verbs being significantly more impaired than nouns in their production. As a consequence, a syntactic deficit can be argued for both patients. On the other hand, the Wernicke's aphasic subject with no V-N dissociation (LI) performed relatively well in both conditions. Her scores should be considered in the light of her mild grade of aphasia: as illustrated in section 2.1, LI suffered a less severe aphasia with respect to ED and ZA.

Secondly, the patients' production of nominalizations was not affected at the semantic level by the number of arguments involved (task 2) and the occurrence vs. the lack of the thematic roles (task 3). This result, taken together with the scores obtained by the two Broca's aphasic subjects in task 1 (i.e., the production of noun-like nominalizations better than that of verb-like nominalizations) and in the screening test (i.e., no difference between the production of one argument verbs and two argument verbs), supports an interpretation of the patients' errors as stemming from a morphosyntactic deficit. In this respect, it is worth stressing that the participants performed relatively better with noun-like nominalizations than with verb-like ones.

At the same time, though, these findings are problematic, especially because of ED's performance; despite his verbal selective deficit, he performed relatively better with verbs than with nominalizations, that is, nominal elements. Moreover, the two Broca's aphasics often substituted a target nominalization with a fully inflected verb and not with a semantically/lexically related noun, as expected and as to some extent done by the Wernicke's aphasic participant LI. These errors could be partially explained pointing out that the stimulus from which the target had to be derived was a verb: producing a fully inflected verb from a neutral verb form is maybe easier or a more canonical task than producing a related noun or DN. Nevertheless, this way of reasoning leaves the fact that the patients often substituted the required nominalization with a past tensed verb (simple past and present perfect) unexplained. In the literature, past tenses are extensively demonstrated to be demanding for aphasic people, especially Broca's aphasic speakers (Bürchert et al. 2005; Friedmann & Grodzinsky 1997; Yarabay Duman & Bastiaanse 2009). Given this scenario, ED and ZA's production of nominalizations does not seem to depend directly on their V-N dissociation, but on a syntactic impairment on the one hand and on the complexity of nominalizations on the other. If correct, this reasoning may lead to the conclusion that DNs are complex nouns, more complex even than verbs. An fMRI study conducted by Siri et al. (2008) comes to the same result. Siri and co-workers asked some Italian normal subjects to name a picture by means of an inflected finite verb, an infinitive or a nominalization, according to the provided instruction. They found no specific cortical activation in the case of verbs; however, they found a greater IFG (Inferior Frontal Gyrus, which involves Broca's area) activation for the production of nominalizations with respect to verbs (both finite verbs and infinitives), that is, an increase of the cognitive resources needed in the nominalization condition. In what does nominalizations' complexity lie?

### *3. Regarding the errors: some final considerations looking at linguistic analyses*

The last issue concerns a possible account for nominalizations' complexity. In what sense are nominalizations more demanding than verbs (at least in the tasks of the present

study)? The greater evidence for nominalizations' complexity is represented by the fact that the subjects suffering verbal selective deficit often substituted the target DN or IS with an inflected verb. It is surprising that in the most cases these substitutions consisted of past tensed verbs since in the literature it is well known that the production of past tensed verbs is demanding for agrammatic people (Bürchert et al. 2005; Friedmann & Grodzinsky 1997; Yarabay Duman & Bastiaanse 2009). Therefore, it seems reasonable thinking that a deeper, linguistic analysis of subjects' errors could highlight something interesting about the nominalization phenomena. In the tables below the substitution errors are reported for each participant. The substitutions of target DNs are listed in table 1, those of target ISs are listed in table 2.

	Finite verbs			Non finite verbs			Non target DNs		
	Present	Present Perfect	Past tense	Infinitive	Past Participle	Present Participle	Gerund		among which <i>nomina agentis</i>
ED	✓	✓		✓	✓			✓	✓
ZA	✓		✓	✓	✓			✓	
LI				✓				✓	✓

Table 1: substitutions of a DN target

	Finite verbs			Non finite verbs			Non target DNs		
	Present	Present Perfect	Past Tense	Infinitive	Past Participle	Present Participle	Gerund		among which <i>nomina agentis</i>
ED	✓	✓		X	✓			✓	✓
ZA	✓	✓	✓	X	✓	✓		✓	
LI				X		✓	✓	✓	

Table 2: substitutions of a IS target

First considering table 1, ED and ZA mostly substituted a target DN with a verb in the infinitive, past participle, present tense, present perfect tense and past tense. On the contrary, LI's substitutions go in the direction that was firstly hypothesized for the other

two patients: besides the substitutions with infinitive, the target DNs were replaced by other non-target DNs. The fact that the stimulus from which the DN had to be derived was a verb in a neutral form is not enough to explain the production of verbs in the past participle, present perfect tense and past tense. It can be noted that in Italian these three verbal tenses share the same kind of aspect, i.e. the perfective aspect. A detailed discussion on aspect does not fall within the aims of this paper. Nonetheless, following Bertinetto (1991) and Salvi & Vanelli (2004), it is possible to argue that the perfective aspect shows an event in its completeness, the endpoint of the event in question being included. On this regard, it is significant that in some cases LI replaced the target DNs with a particular kind of nominalization, the *nomina agentis* ending in *-tore*, similar to English *-er* nominals, which typically denotes the external argument of the underlying predicate. In fact, as argued in Lo Duca (2004), differently from other kind of *nomina agentis*, the *nomina agentis* ending in *-tore* can receive event-reading and bear perfective value. In other words, this kind of *nomina agentis* can refer to non-generic events and to a single occurrence of the relevant event<sup>10</sup>. If it is true that subjects' errors are not accidental, but are aspect-driven, two observations have to be drawn. Firstly, aphasic data seem to suggest that, at least in theory, every kind of nominalization can receive event-reading and be linked to an event structure (as argued in Alexiadou & Schäfer 2010). In fact, the three participants replaced a target nominalization with a verb even in those conditions where a non-event-reading was supposed (see task 3). Secondly, since subjects' substitutions can be comparable as far as the perfective aspect is concerned, it follows that the event described in an Italian DN is preferably seen in its completeness. If this reasoning is on the right track, it cannot be a case that the subjects performed relatively better with nominalizations ending in *-(a)ta*, a suffix that is peculiar to Italian past participle, than with nominalizations ending in *-mento e -zione* (19)<sup>11</sup>. The fact that DNs in *-(a)ta* mainly refer to single, inherently bound events (Gaeta 2004) goes in hand with the perfective value carried by the Italian past participle suffix. In turn, subjects' preference for DNs in *-(a)ta* well fits within the hypotheses that analyse subjects' substitutions in terms of aspect.

(19)	<i>-(a)ta</i> DNs	<i>-mento/-zione</i> DNs
	ED: 9/20	ED: 1/10
	ZA: 8/20	ZA: 0/10
	LI: 19/20	LI: 6/10

Considering table 2, ED and ZA committed the same kind of substitutions even in the case of target ISs. Hence they kept on preferring a perfective reading of the event described in the nominalizations in spite of the compatibility of the *infinito sostantivato* with an atelic value and therefore with an imperfective reading (i.a.: Vanvolsem 1983; Zucchi 1993). More interestingly, LI's substitutions of target ISs are different from those of target DNs. It

<sup>10</sup> For example, the *nomina agentis* in sentence in (i) can be paraphrased as "the person who rescued x" referring not to a generic person who habitually rescues people, but to the precise person that in a precise moment has rescued John.

(i) *Fortunatamente il soccorritore di Gianni è un bravo infermiere.*  
Thankfully the rescuer of John is a good nurse.

<sup>11</sup> In this respect, Melloni (2007) noted that in Italian affixes such as *-zione* inherit the inner aspect properties of the base verb while others, as *-ata*, modify the inner aspect of the verb.

is worth reminding here that LI does not seem to suffer the same syntactic deficits which affect the other two subjects' production. It is likely that her errors may reflect a phonological/lexical impairment rather than a syntactic one. Her substitutions of target ISs consisted of gerunds and present participles which are comparable with the IS as for: (i) the unlimited productivity with all verbal roots; (ii) the possibility of assign accusative case and (iii) the [+ durative] and [- telic] values (Benincà & Cinque 1991; Lo Duca 2004). Significantly, LI never substituted target DNs with gerunds or present participles on one hand and target ISs with *nomina agentis* in -tore on the other. Under these circumstances, it should be likely that LI substituted the required nominalizations just with those verbs or those nominals that could maintain the syntactic properties and the semantic values of the targets whenever the retrieval of the targets in question was prevented because of her phonological/lexical problems. LI could take advantage of such a strategy since her milder (and fluent) aphasia with respect to ED and ZA's more severe (and non-fluent) aphasia.

In conclusion, errors' analysis enlightens the crucial role played by the Aktionsart, the kind of the event structure and, to some extent, the grammatical aspect in the nominalization phenomena. In this respect, the data from aphasia seem to be in line with those linguistic analyses that explain the variation among the subtypes of nominalizations in terms of different event structures and different aspect projections (Alexiadou 2001 and following works; Borer 2005; Fábregas & Marín 2012 based on Ramchand 2008; Sichel 2010) rather than with those analyses that posit the differences in dichotomies such as the occurrence vs. the lack of the arguments or the event vs. the non-event reading (Grimshaw 1990). For example, capitalizing on Harley & Noyer (2000) and Pesetsky (1995), Sichel (2010) noted that it is not possible to derive a transitive DN from English verbs displaying an inchoative/causative alternation (20) unless the syntactic subject of this kind of verbs is understood not only as the cause of the event (21b), but also as the direct participant to the event (21c).

- (20) a. \*Bill's growth of tomatoes  
Bill grew tomatoes / Tomatoes grew  
b. Bill's cultivation of the tomatoes  
Bill cultivated the tomatoes/ \*The tomatoes cultivated
- (21) a. The weather gradually improved her mood  
b. #The weather's alteration of her plans  
c. The wind's alteration of the position of the rock

On Sichel's account, the restriction on the direct participant is a consequence of the kind of the event a DN can represent. Briefly, an event consists of two sub-events: the first one is made up by the verbal root and its internal argument, the second one is the external argument. In a simple, single event the two sub-events must overlap, that is, (i) the sub-events must have the same spatial and temporal properties and (ii) these properties must be the predicates of an entity that is necessarily a participant in both sub-events. Definitively, "if a simple event includes an external argument, the participation of the argument is co-temporal with the initiation of the event" (Sichel 2010). It follows that "when the participation of the external argument is not co-temporal the event is a complex one". In this sense, the DNs are compatible with simple events only, while more verbal nominalizations such as the English *-ing* nominals are compatible with complex events as well. In fact, differently from the DNs, *-ing* nominals are grammatical with a non direct

participant external argument, as in the case of *-ing* nominals derived from verbs displaying an inchoative/causative alternation (22):

- (22) a. Bill's growing of tomatoes  
b. Bill's growing tomatoes  
c. #Bill's growth of tomatoes

Although the English causative verbs class does not perfectly overlap the Italian one, this kind of analysis seems to hold for Italian nominalizations as well. Italian causative verbs, although less frequent than the causative periphrases, mostly overlap with ergative verbs. Interestingly, Italian nominalizations derived from simple causative verbs behave the same of the corresponding English nominalizations. When the external argument is present, the ND is out while the related IS is perfectly grammatical (23; 24).

- (23) a. *La crescita dei pomodori (\*da parte di Gianni)*  
'(\*John's) growth of tomatoes'  
b. *Il crescere i pomodori da parte di Gianni*  
'John's growing tomatoes'  
(24) a. *La guarigione dei vitelli (\*??da parte del veterinario)*  
'(\*Veterinarian's) recovery of calves'  
b. *Il guarire i vitelli da parte del veterinario*  
'Veterinarian's recovering calves'

Thus, as in English, in Italian the DNs cannot host complex events. It is not a case that the above examples on DNs (23a; 24a) turn out grammatical when the prepositional phrase introducing the external argument *da parte di* 'by' is replaced with other phrases, such as *per opera di*, lit. 'at the hands of' or *per volontà di*, lit. 'at the wish of', that can be analysed as further nominalizations. It is to say that two DNs are needed in order to describe a complex event. As Giorgi (1988) noted, the phrase 'da parte di' indicates the origin of the event, that is, the direct participant in terms of Sichel (2010). Moreover, when the internal argument is [-animate] and so there is no ambiguity about the origin of the event, the simple preposition *di* 'of' can replace the phrase *da parte di* (25), but not *per volontà/opera di* (26). Significantly, in the case of ISs the phrase *da parte di* can introduce not only the direct participant, but also an external cause. This is to be drawn from IS' more complex, verbal structure.

- (25) a. *La mangiata di caramelle gommose da parte di Simone*  
b. *La mangiata di Simone di caramelle gommose*  
'Simone's eating of gumdrops'  
(26) a. *La crescita dei pomodori per opera di Gianni*  
b. *#La crescita di Gianni dei pomodori*  
'The growth of tomatoes (due to the work of John)'

By the end, Sichel's analysis can account for Italian nominalizations as well. In her view, the different properties of nominalizations have to be derived from the different kinds of event structure a nominalization can host. If this arguing is correct, it is possible to reinterpret subjects' problems with nominalizations in terms of event structure rather than

in terms of argument structure or syntax. More precisely, the relatively better performance with DNs than with ISs is not just a matter of difference between noun and verb syntax, but also a matter of difference between the various event structures. In fact, according to Sichel (2010), the more nominal or more verbal properties of a nominalization are firstly to be derived from the kind of event structure (simple vs. complex). Thus, subjects' performance can be explained as a preference for nominalizations hosting simple events with respect to nominalization hosting complex events and their substitutions errors as morphological strategies in the effort to retrieve the event properties of the target nominalizations.

As the same author claims, Sichel's analysis can be integrated with other approaches, as that elaborated by Alexiadou (2001 and following works) and above described (see section 2.3). Crucially, both approaches stress that the linguistic data in nominals are better captured above the lexical root level and have not to be derived from the occurrence vs. the lack of arguments or the event vs. the non-event reading. Sichel's constraint on event structure can be understood as a constraint on the kind of morphological and syntactic properties a nominalization can host. Capitalizing on Alexiadou's works, it is possible arguing that nominalizations (at least Italian nominalizations) hosting simple events lack some verbal projections such as AspP, while nominalizations hosting complex events (i.e. IS) can enter a syntactic derivation in which AspP is allowed. Alexiadou and Sichel's analyses, taken together, can account for the aspect-driven substitution errors committed by the subjects of the present study since they enlighten the link between event structure, Aktionsart (or inner aspect in the spirit of Verkuyl 1993), grammatical aspect (or outer aspect) and syntactic properties. On this regard, an analogous proposal is developed in Fabregas & Marín (2012) on the basis of Ramchand (2008). According to Ramchand (2008), in the first phase of the syntactic derivation there are three relevant projections for the introduction of the arguments: (i) *initP* which introduces the causation event and licences the external argument; (ii) *procP* which specifies the nature of the change or process and licenses the entity undergoing change or process; (iii) *resP* which gives the result state of the event and licenses the entity that comes to hold the result state. Fabregas & Marín (2012) claim that nominalizing affixes could spell out any of these three verbal heads giving rise to different interpretations that are sensitive to inner aspect (Aktionsart). For example, the suffix *-ing* could realize both process and initiator.

In sum, even if from slightly different perspectives, all these approaches stress the crucial role of the inner (and outer) aspect in the nominalizations' derivation and this is in agreement with the analysis developed for the substitution errors made by the subjects of the present study. If this reasoning is on the right track, a tentative answer to the initial question can be given. In what does nominalizations' complexity lie? In what sense are nominalizations more demanding than verbs (at least in the tasks of the present study)? The above discussion has emphasized the role of the aspect in nominalizations' derivation. Capitalizing on the analysis put forward so far, it could be argued that Aktionsart and aspect (and not thematic roles) must necessary show up at a semantic and syntactic levels in order to turn a full referential noun into an event. In syntax, events can be fully realized in the DP or in the CP domain: in the former case they behave as nominalizations, in the latter they behave as verbs. In general, aspect (especially outer aspect) is a property of verbs, but not of full referential nouns. Nominalizations are still referential (Giorgi & Longobardi 1991; Longobardi 1994, 2001; Simone 2008), but they refer to events (i.e. can express Aktionsart and aspect) as well. Reminding Ross' categorial space (see section 1.1), it is possible arguing that nominalizations are set in an intermediate position between the two edges represented by the canonical verbs and the canonical nouns. This is to say that

nominalizations express aspect in a less canonical way than the verbs do. Therefore, in the effort of retrieving the aspect –crucial for turning a full referential noun into an event- the subjects of the study found it easier to produce a verb than the required nominalization given that the former bears aspect in a more “canonical” way. Ultimately, the subjects did not replace a target nominalization with a verb as such, but with a verb as a word that can express aspect and that was available for some reasons in their mind in order to fulfil the requirements of the task. Further studies are needed in order to confirm these suppositions.

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