

Verb semantics in aphasia: truly categorial effects or artifacts?

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Verb semantics in aphasia is the central issue of this paper. Elsewhere (Finocchiaro, 1999; Finocchiaro e Miceli, in preparation) new evidence for the categorial organization of verb knowledge in the brain has been reported. Here, two single-case studies, seemingly showing actional and/or 'purely semantic' (i.e. non actional) category-specific deficits are presented. However, on closer analysis, the categorial interpretation of the observed dissociations was implausible, and due to the effect of other variables. Although not denying the psychological relevance of the actional classification, these data suggest that heterogeneous factors, such as morphological complexity, syntax and semantics (in a broad sense) can often determine category-like effects*.

1. Introduction

It has often been claimed that lexical (e.g. frequency) and contextual (e.g. presentation of the stimuli in isolation or in context) variables may influence the behaviour of aphasic patients, altering their performance and producing artifactual dissociations. When very selective deficits are considered, the origin of aphasics' performance may remain controversial or unknown even when the main variables are controlled.

Three reasons for the 'deficit interpretation problem' can be identified:

- a) Inadequacy of the tests, sometimes not specific enough to catch very subtle deficits;
- b) Overlapping of two or more deficits;
- c) Linguistic motivations.

The third point is perhaps the most intriguing, in so far as it concerns the inherent nature of linguistic elements. For example, a noun is not only a syntactic element, it is characterized by its own semantic and morphological features, it may occur with a higher frequency in a particular context or in a particular social environment. Thus it is very difficult to match the stimulus nouns for syntactic, semantic, morphological and pragmatic characteristics, in order to determine which aspect of the noun the patient is sensitive to.

It is worth noting that both semantic and syntactic hypotheses

are sometimes provided as plausible explanations of the same phenomena. This is observed with syntactic category-specific deficits. Several studies have shown that brain damage can selectively affect specific grammatical word categories, such as nouns vs. verbs (Miceli et al. 1984; Zingeser & Berndt 1988; De Renzi & Di Pellegrino 1995; Rapp & Caramazza 1997). However, two alternative, semantically based accounts of these effects have been provided. Differences between the grammatical categories of nouns and verbs might be reduced to: a) different degrees of abstractness/concreteness of their meaning (nouns being in general more concrete than verbs); b) differences between the semantic categories of actions and objects (many verbs corresponding to actions, and many nouns to objects).

Regarding hypothesis (a), there is good evidence, from some patients at least, that the noun/verb difference cannot be reduced to potential differences in abstractness (Caramazza & Hillis 1991; De Renzi & Di Pellegrino 1995; Berndt et al. 1997; Rapp & Caramazza 1998). Regarding hypothesis (b), to my knowledge it has not been tested in the reported cases. However, it is worth noting that the action/non-action and object/non-object distinctions overlap considerably with the abstractness/concreteness distinction (non-object nouns and non-action verbs being more abstract).

To the extent that this is true, the finding that noun/verb differences cannot be reduced to abstractness/concreteness differences also lends some support to the assumption that at least some of the observed dissociations reflect differences between grammatically defined categories.

However, this issue cannot be considered entirely resolved for all the observed dissociations. The fact that both syntax and semantics may provide available hypotheses of the reported effects is not surprising: the various aspects of a linguistic element are so tightly connected, that it is extremely hard to keep them apart.

This is particularly true when verb semantics is at stake.¹ Verbs have a very complex semantics and non-univocal referents, so they can be potentially classified in different ways with respect to the parameters selected (for example, they can be classified with respect to their actional or empirically-grounded features).

In addition, verbs have very strong syntactic consequences, so that, whatever kind of classification is adopted, there is a high risk of artifactual dissociations, their true origin (syntactic or semantic) remaining often uncertain. The absence of neuro-linguistic studies specifically concerning verb semantics can be due, at least in part, to the 'puzzling' nature of verbs.

However, dissociations among semantic categories of nouns (non-living things vs. living things, with finer distinctions between animate vs. inanimate; humans vs. animals, etc.) have often been reported (Sartori & Job 1988; Silveri & Gainotti 1988; Hillis & Caramazza 1991; De Renzi & Lucchelli 1994; Damasio et al. 1996; Caramazza & Shelton 1998). These observations lead to the belief that verbs are also categorially organized in the brain. This prediction was tested elsewhere (Finocchiaro 1999; Finocchiaro & Miceli, in preparation), providing evidence for the view that aphasic patients may be sensitive at least to verb actionality (the basic notions concerning the actionality domain will be summarized in the next section). Furthermore, it seems that: (a) an actional category-specific deficit may differently affect production and comprehension ability; (b) retrieving of actional category information may be influenced by the type of presentation, in isolation or in context.

In this paper, two single-case studies will be presented, that at first sight seem to be sensitive to the actional and/or the 'purely semantic' category of verbs.² However, on closer analysis, the categorial interpretation of the deficits reported will prove to be implausible, the categorial effects stemming from the interference of other (syntactic, morphological, broadly semantic) variables. Although not denying the psychological relevance of the actional classification, the data reported here confirm how complex verb semantics is, and how careful we must be in evaluating the aphasics' performance on verbs.

2. Theoretical background

Actionality offers the most articulate and solid framework to study verb semantics (Vendler 1957; Kenny 1963; Comrie 1976; Taylor 1977; Mourelatos 1978; Dowty 1979; Bertinetto 1986; Verkuyl 1993). On the basis of largely used syntactic tests, six actional classes were distinguished: States (e.g. *to be*, *to stay*, *to think*), Processes (e.g. *to walk*, *to swim*, *to talk*), Punctuals (e.g. *to fall*, *to hit*), Accomplishments (e.g. *to erase*, *to digest*, *to fill up*), Achievements (e.g. *to die*, *to be born*, *to reach the top*), and Gradual completions (e.g. *to fatten (up)*, *to dry (up)*).³

All verbs are dynamic except States. States, Processes and Accomplishments have a duration, i.e. take time, while Punctuals and Achievements refer to point-events. Accomplishments and Achievements have the telicity feature, i.e. the denoted event contains an end-point.

In Table (1), a list of syntactic tests is provided (see Bertinetto 1986). Since the patients tested were Italians, Italian is adopted here.

The syntactic tests used, verify either (a) the compatibility with a given adverbial, or (b) the possibility of the progressive form.

It is worth noting that a given adverbial can sometimes take on different interpretations, depending on the actional value of the verb. Thus, with durative verbs, the adverbial 'for x time' can take only the durative meaning (e.g. *John played tennis for two hours* means that the event of playing went on for two hours). With ('reversible') Achievements, by contrast, 'for x time' can only refer to the 'resulting state', after which the situation denoted by the verb turns into the reverse situation. For instance, *John went out for two hours*, means that John went out, remained out for two hours, and came back afterwards.

Table 1

Syntactic test	Features	States	Process.	Punct.	Accomp.	Achiev. compl.	Gradual
"A t in punto" = 'At t'	Punctual	-	-	+	-	+	(-) ⁴
"Per x tempo" = 'For x time'	Durative	± ⁵	+	-	+	-	(+) ⁴
"Per x tempo" = 'For x time'	Inversion	-	-	-	-	± ⁵	-
"In x tempo" = 'In x time'	Telic	-	-	-	+	+	+
"Di molto, di poco, di parecchio" ⁶	Gradual	-	-	-	-	-	+
Progressive form	Dynamic/durative	-	+	-	+	- ⁷	+
Progressive form	Imminent	-	-	-	-	+	(±) ⁴

As to the progressive form, it usually focuses on the event's dynamic duration (e.g. *John is playing tennis*); thus, it is incompat-

ible with States (as they do not refer to dynamic events) and point-events (since, ideally, they have no duration). However, with Achievements, it usually refers to 'imminent' events, i.e. to events that are going to happen (e.g. *John is leaving*).

Actional categories are usually classified with respect to three main features: dynamicity, durativity and telicity. 'Graduality', the distinctive feature of gradual completion verbs (see Bertinetto and Squartini 1995), may be added to the traditional features (see Table (2)).

Table 2

Actional categories	Dynamicity	Durativity	Telicity	Graduality
States	-	+	-	-
Processes	+	+	-	-
Punctuals	+	-	-	-
Accomplishments	+	+	+	-
Achievements	+	-	+	-
Gradual Completions	+	±	±	+

Dynamicity distinguishes States ([-dynamic]) from the other ([+dynamic]) verbs. States, Processes and Accomplishments have a duration, i.e. take time, while Punctuals and Achievements ideally refer to 'point-events'. Telicity only pertains to Accomplishments and Achievements, i.e. to verbs with an inherent end-point.

In addition, in order to classify verbs with respect to non-actional properties, some proposals suggested by Levin (1993) and Levin & Rappaport Hovav (1995) were adopted. According to these authors, it is possible to distinguish semantically related classes of verbs, sharing the same syntactic behaviour. Note that in this view, the correspondence between verb meaning and syntactic behaviour might also have psychological motivations. Namely, the informational load carried by the lexical entry would be minimized, in the sense that the predictable information common to the verbs of each semantic class could be factored out. The lexical entry would then carry only idiosyncratic information.

This classification system implies that the selected classes are highly language-specific, in so far as the meaning components with syntactic relevance differ across languages. Here is a list of some of the verb

classes individuated by Levin (1993) for English: Putting, Removing, Sending and carrying, Learning, Concealment, Hold and keep, Throwing, Combining and attaching, Cutting, Separation and disassembling, Colour, Creation and transformation, Engender, Perceiving, Psychological, Judgement, Assessment, Social interaction, Communication, Animal sounds, Killing, Emission, Movement, Existence, Aspectual, Meteorological, Research. Each class may further be divided into a number of sub-classes. The verbs of each sub-class may share a specific meaning feature with respect to the verbs of the whole class (thus, they may specify the manner, the mean or the direction of an action). A sub-class may also be identified on the basis of syntactic (such as the obligatory presence of an agent subject) or even morphological criteria (such as the zero-relation between the verb and the corresponding noun).

However, there is a number of problems with this kind of classification. First of all, the criteria by which semantic classes are distinguished are loosely defined. Second, even if syntactic tests are used, they are often 'empirically-guided' rather than theoretically motivated (it is unclear when a certain set of verbs is considered a class or a sub-class). Third, there are too many separate classes (49), and some sub-classes contain only one member.

Obviously, it does not make much sense to test the cognitive import of 49 classes, or sub-classes with only one member.

Thus, the authors' system was modified, without considering syntactic import by adopting a purely empirical perspective. For this reason, this classification was labelled 'purely semantic'. This approach is not unreasonable, in so far as the perception of empirical features could have guided the classification of verbs in the brain.

The following classes were distinguished:

- 1) Movement verbs (e.g. *to walk*);
- 2) Verbs of existence, state, appearance, disappearance (e.g. *to live*);
- 3) Verbs of psychological, perceptible, cognitive activities (e.g. *to love*);
- 4) Verbs of emission and communication (e.g. *to phone*);
- 5) Verbs of change of state (e.g. *to cut*);
- 6) Verbs of manual, domestic and creative activities (e.g. *to build*);
- 7) Reciprocal verbs (e.g. *to marry*);
- 8) Transition verbs (e.g. *to give*);
- 9) Possessive verbs (e.g. *to belong*).⁸

3. Participants and methods

The verb stimuli selected were matched for frequency of occurrence (Bortolini et al. 1971; De Mauro et al. 1993) and syntactic com-

plexity across actional and semantic categories.⁹ However, gradual completion verbs were on average less frequent with respect to the other verbs; this is because gradual completion verbs with a higher frequency were not attested in the consulted lexicons.¹⁰ Furthermore, process verbs resulted syntactically more complex than the other verbs because of their inherent characteristics (see below). The degree of syntactic complexity was defined on the basis of three main parameters: (i) possibility of transitive and intransitive constructions; (ii) classification of intransitive verbs as unaccusative and/or unergative; ¹¹ (iii) valence. Double classification with respect to a single parameter and triple valence were considered markers of high syntactic complexity. Syntactic complexity was calculated separately for each actional interpretation that a single verb could take. Thus, *to read* can be used transitively and intransitively as Process (e.g. *John read for hours*, intrans. and *John read books for hours*, trans.), but only transitively with quantified objects as Accomplishment (*John read a book* vs. **John read*). Thus, Processes were syntactically more complex with respect to the other verbs, as they often allow both transitive and intransitive constructions, in contrast to States, which are often intransitive (e.g. *to be* vs. **to be something*), and Accomplishments, which are often transitive.

Here, the data of two patients are reported: their main characteristics (name, age, sex, level of instruction, lesion site and time of onset) are summarized in Table (3).

Table 3

Name	Age	Sex	Level of instruction	Lesion site	Time of onset (months)
C.De.	40	f	secondary school	left fronto-parietal	1
E.Mi.	56	m	primary school	left frontal	2

The following tests were submitted (in order of presentation):

- 1) Picture naming;
- 3) Naming from definition (oral input);
- 4) Grammaticality judgements;
- 5) Morphological test.¹²

The morphological test will be described while dealing with E.Mi. It is worth stressing that the behaviour of the patients was highly idiosyncratic; other patients who were submitted to the same tests showed quite different behaviours.

The performance of 22 controls was preliminarily analyzed.¹³ The control group was homogeneous with respect to the following

parameters: age, sex, level of instruction. Furthermore, in order to control for the effect of the concrete/abstract dimension, another group of 20 participants rated the verbs using a scale from 1 (very abstract) to 5 (very concrete).¹⁴

1) Picture naming

Sixty-four action pictures were used. Participants were asked to provide the verb represented by each picture. Tenses and moods selected by participants were ignored. Any form semantically related to the target, nominalizations, neologisms, no-responses were scored as incorrect. The average accuracy of the control group was 97.1% (S.D. = 1.22), with no significant difference between telic (96.6%; S.D. = 2.77) and atelic verbs (97.5%; S.D. = 2.03).

2) Naming from definition (oral input)

The same 64 verbs were used. In addition, 21 abstract and hardly depictable verbs, especially States, Achievements and Accomplishments, were introduced. For each, a short and syntactically simple definition (no longer than one line) was created. Dictionary definitions were not used, as concrete and familiar terms were preferred.

The definitions were read by the examiner. Participants were requested to provide the corresponding verb, avoiding circumlocutions.

The same criteria used for the picture naming task were adopted in the evaluation of the responses. The average accuracy of the control group was 97.8% (S.D. = 2.14), with no significant difference between telic (97.35%; S.D. = 3.41) and atelic verbs (98.29%; S.D. = 1.48).

3) Grammaticality judgements

Both verbs (24) and nouns (24) were used as stimuli. The verbs were telics (6 Accomplishments, 6 Achievements) and atelics (12 Processes). The nouns were count-nouns (12) and mass-nouns (12). Each stimulus was inserted in two different contexts, only one of which was correct.

For each sentence, participants were requested to provide a grammaticality judgement (the concept of grammatical correctness was clearly explained) answering questions like: "Is this sentence grammatically correct"? The sentences were orally presented by the examiner.

Correct contexts were constructed as follows:

- a) telic verbs were used with the adverbial "in x tempo" = 'in x time', and with quantified subjects and objects, enforcing a telic interpretation of the situation (e.g. *Mario è arrivato in ufficio in dieci minuti* = 'Mario arrived at the office in ten minutes');
- b) atelic verbs were used with the adverbial "per x tempo" = 'for x time' (e.g. *Gli operai hanno lavorato sodo per due giorni* = 'Workers worked hard for two days');
- c) count-nouns were preceded by cardinal numbers or definite articles (e.g. *Il mio vicino mi ha affidato sei cani* = 'My neighbour entrusted six dogs to me');
- d) mass-nouns were preceded by explicit or implicit mass-quantifiers (e.g. *Giulio e io abbiamo comprato il latte al supermercato* = 'Giulio and I bought milk at the supermarket').

Incorrect contexts were constructed as follows:

- a) telic verbs were used with the adverbials "per x tempo" = 'for x time' or "fino a x time" = 'until x time', where the sentence cannot take on an atelic interpretation (e.g. **Mario è arrivato in ufficio per dieci minuti* = '*Mario arrived at the office for ten minutes');
- b) atelic verbs were used with the adverbial "in x tempo" = 'in x time' (e.g. **Gli operai hanno lavorato sodo in due giorni* = '*Workers worked hard in two days');
- c) count-nouns were preceded by the expression "un po' di" = 'a little of' (e.g. **Il mio vicino mi ha affidato un po' di cane* = '*My neighbour entrusted a little of dog to me');
- d) mass nouns were preceded by count-quantifiers, where the mass-noun could not take on a count sense (e.g. **Giulio e io abbiamo comprato i lattini al supermercato* = '*Giulio and I bought milks at the supermarket').

Perfective morphology (namely, the compound past) was used, both in correct and incorrect sentences. The sentences were divided into two lists in such a way that: a) a given stimulus occurred once in each list; b) each list contained an equal number of correct and incorrect sentences; c) each list contained an equal number of stimuli for each verb category (telic and atelic) and for each noun category (count and mass). Each list contained 48 sentences. Lists were submitted on different days.

The average accuracy of the controls was 96.5% (S.D. = 3.50). Their performance significantly varied with respect to:

- a) word class: nouns (98.95%; S.D. = 1.32) vs. verbs (94.24%; S.D. = 6.07);
- b) count-nouns (100%) vs. mass-nouns (97.9%; S.D. = 2.65);

c) telic verbs (95.29%; S.D. = 5.68) vs. atelic verbs (89.56%; S.D. = 9.86).¹⁵

Thus, controls found verbs significantly more complex than nouns (paired T-test: $T = 3.40$, $p = 0.003$), mass-nouns more complex than count-nouns (paired T-test: $T = 3.16$, $p = 0.006$), atelic verbs more complex than telic verbs (paired T-test: $T = 4.56$, $p = 0.0003$).

According to a largely accepted procedure, aphasics' dissociations showing the controls' pattern can be considered pathological only if the difference between each two categories overcomes controls' mean difference by at least 2.5 standard deviations.

For controls, the mean difference between nouns/verbs was 4.71 (S.D. = 5.5). [Mean difference + 2.5 S.D. = 18.46].

The mean difference between count-/mass-nouns was 2.1 (S.D. = 2.65). [Mean difference + 2.5 S.D. = 8.72].

The mean difference between telic/atelic verbs was 5.7 (S.D. = 5.02). [Mean difference + 2.5 S.D. = 18.25].

4. Results

4.1. C.De.

4.1.1. Picture naming

C.De. correctly named 20/64 action pictures (31.2%). She correctly produced 15/37 (40%) atelic verbs (11/20, or 55% Processes; 3/14, or 21.4% Punctuals; 1/3, or 33.3% States), and 5/27 (18.5%) telic verbs (4/14, or 28.5% Achievements; 1/7, or 14.2% Accomplishments; 0/6 = 0% Gradual completions).

The telic/atelic difference was not significant ($p > 0.05$), but C.De. showed a striking preference for the process verb category (Processes: 11/20, or 55% correct; Verbs of other categories: 9/44, or 20% correct; $\chi^2 = 6.11$, $p = 0.01$).

As for the purely semantic classification, C.De. showed a slight preference for Movement verbs with respect to other verbs, but the difference was not significant (Movement verbs: 5/12, or 41.6% correct; Other verbs: 15/52, or 28.8% correct; $p > 0.05$).

Incorrect responses, uniformly distributed across action categories, consisted of nominalizations (23/64), semantic errors (13/64), misses (8/64).

4.1.2. Naming from definition

C.De. provided the correct verb for 20/85 definitions (23.5%). Her

performance was poorer with respect to the preceding test, the number of misses drastically increasing (43/85). She correctly produced 15/46 (32.6%) atelic (11/20, or 55% Processes, 4/16, or 25% Punctuals), and 5/39 (12.8%) telic verbs (3/17, or 17.6 Achievements; 1/13, or 7.6% Accomplishments; 1/9, or 11.1% Gradual completions).

The advantage for Processes with respect to verbs of other action categories was confirmed (Processes: 11/20, or 55% correct; Verbs of other categories: 9/65, or 13.8% correct; $\chi^2 = 12.19$, $p = 0.0004$). Collapsing the two naming tasks together, C.De. was accurate for 55% of the Processes, and for 16.9% for verbs of other categories ($\chi^2 = 18.92$, $p = 0.00001$).

The better performance for the semantic category of Movement verbs, no more than a tendency in the preceding test, proved significant here (Movement verbs: 8/14, or 57.1% correct; Verbs of other categories: 12/71, or 14.8% correct; $\chi^2 = 8.41$, $p = 0.003$).

Table 4. C.De.'s correct responses in Picture naming and in Naming from definition tasks.

	Picture naming	Naming from definition
Processes	11/20 (55%)	11/20 (55%)
Verbs of other actional categories	9/44 (20%)	9/65 (13.8%)
Movement verbs	5/12 (41.6%)	8/14 (57.1%)
Verbs of other purely semantic categories	15/52 (28.8%)	12/71 (14.8%)

4.1.3. Grammaticality judgements

C.De. provided 78/96 correct responses (81.2%). Her performance was significantly better for nouns than for verbs (Nouns: 44/48, or 91.6% correct; Verbs: 34/48, or 70.8% correct; $\chi^2 = 5.53$, $p = 0.01$).

C.De. was equally accurate on telic and atelic verbs (17/24, or 70.8% on both categories), and on count- and mass-nouns (22/24, or 91.6% on both categories).

Discussion

The striking preference for Processes apparently depends on actionality, in so far as C.De.'s performance did not vary with respect to frequency (Processes were not more frequent than other verbs) and agentivity (collapsing the two naming tasks together, C.De. cor-

rectly produced 26/66, or 39% [+agentive], and 9/39, or 23% [-agentive] verbs; $p > 0.05$).

Moreover it could be claimed that the patient was also sensitive to purely semantic factors, where movement verbs had an advantage.

Thus, it appears that C.De., in orally producing verbs in isolation, ¹⁶ suffers from two independent category-specific deficits: an actional deficit, and a purely semantic one.

Although the co-occurrence of two category-specific deficits is not theoretically impossible, a careful analysis is necessary before making such a claim. Crucially, we have to investigate whether a single deficit could be responsible for the two semantic dissociations reported.

The abstract/concrete dimension could provide the key, in so far as both process and movement verbs are expected to present a high degree of concreteness.

This claim is supported by control ratings of the verbs' concreteness (see section 3). Process verbs were rated as more concrete with respect to the verbs of other actional (Processes: 4.22 (S.D. = 0.59); Other verbs: 3.37 (S.D. = 0.42); paired T-test: $T = 7.42$, $p < 0.0001$), and Movement verbs were rated as more concrete than verbs of other purely semantic categories (Movement verbs: 3.95 (S.D. = 0.68); Other verbs: 3.51 (S.D. = 0.4); paired T-test: $T = 4.04$, $p = 0.001$). Moreover, some crucial data provide additional evidence:

- a) In the naming from definition task, the overall performance decreased with respect to the picture naming task, probably because definitions are much more abstract than pictures. In the naming from definition task a set of 21 hardly depictable, quite abstract verbs were included;
- b) C.De. correctly produced only one state verb (*sedere* = 'to sit') in the picture naming task, and no State in the naming from definition. The verb *sedere* was concrete (mean rating: 3.7), but States were rated, on the average, as the most abstract set of verbs used in the naming tasks (States: 2.24 (S.D. = 0.48); Other verbs: 3.75 (S.D. = 0.45); paired T-test: $T = 12.56$, $p < 0.0001$).
- c) In naming from definition, C.De. correctly produced 20/85 (23.5%) verbs, but none of the 21 hardly depictable, abstract verbs, included in the test was named correctly ($\chi^2 = 6.93$, $p = 0.008$).

To summarize, C.De. seemed to be sensitive both to actional and purely semantic factors. However, as shown, the patient's preference for process and movement verbs could be due to the preference for concrete verbs. If this hypothesis is correct, the two semantic (actional and non-actional) dissociations are artifacts or by-products, due to the high concreteness degree of both process and movement verbs. It

is worth stressing that even the significant advantage for nouns over verbs in the grammaticality judgements could be due to a concreteness effect (nouns being, in general, more concrete than verbs; see introduction). Given the whole pattern of results, the syntactic origin of the Noun/Verb difference is less probable.

4.2. E.Mi.

4.2.1. Picture naming

E.Mi. correctly named 47/64 pictures (73.4%), with a performance significantly below the normal range. E.Mi. correctly produced 33/37 (89%) atelic and 14/27 (52%) telic verbs ($\chi^2 = 9.32$, $p = 0.002$). However, this difference in performance seemed to be independent of telicity as such, because E.Mi.'s accuracy with Achievements and Accomplishments exceeded 70%; gradual completion verbs were impaired (Gradual completions: 1/6, or 16% correct; Verbs of other categories: 46/58, or 79% correct; $\chi^2 = 7.96$, $p = 0.04$). The errors consisted of nominalizations (9/17), semantic paraphasias (5/17), misses (3/17).

4.2.2. Naming from definition

E.Mi. provided the correct response to 33/85 definitions (38.8%). His performance was much poorer than in the preceding test.

The telic/atelic difference was not significant: E.Mi. correctly produced 20/46 atelic (42.5%) and 13/39 (34.2%) telic verbs. Gradual completions were the most impaired verbs: although the difference was not significant, the results showed the same pattern as in the preceding test (Gradual completions: 1/9, or 11% correct; Verbs of other categories: 32/76, or 42% correct). The difference was again significant collapsing the two naming tasks together: $\chi^2 = 9.19$, $p = 0.002$ (Fig. 1).

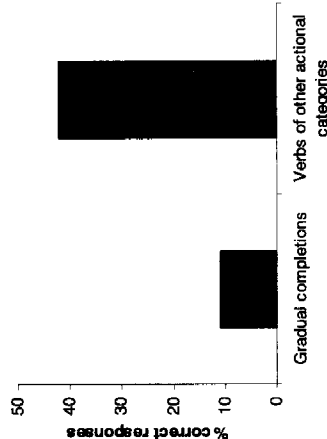


Fig. 1. Percentage of correct responses on Gradual completions vs. other actional categories in the naming tasks (patient E.Mi.).

4.2.3. Grammaticality judgements

E.Mi. correctly evaluated 82/96 sentences (85.4%), with a performance below the normal range. The Noun/Verb difference (nouns: 47/48, or 98% correct; verbs: 35/48, or 72.9% correct; $\chi^2 = 10.12$, $p = 0.001$) seems to be due to the poor performance on atelic verbs. Telic verbs, on the other hand, were relatively preserved (atelic verbs: 14/24, or 58.3% correct; telic verbs: 21/24, or 87.5% correct; $\chi^2 = 3.79$, $p = 0.05$).

The errors involved rejecting the appropriate syntactic contexts (6/14), or accepting incorrect ones (8/14).

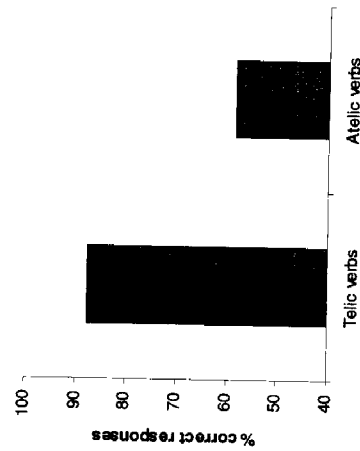


Fig. 2. Percentage of correct responses on telic and atelic verbs (patient E.Mi.).

Discussion

E.Mi. apparently showed two kinds of dissociation: gradual completion verbs (significantly more impaired) vs. verbs of other actional categories (less impaired) in the two naming tasks; atelic (significantly more impaired) vs. telic verbs (less impaired) in the grammaticality judgements task.

These two aspects of E.Mi.'s behaviour will be considered separately.

Naming tasks: gradual completion verbs vs. verbs of other actional categories

Before claiming that the dissociation reported has a truly actional origin, the interference of other factors (frequency, concreteness, agentivity, purely semantic factors) shall be ruled out.

As for frequency, the gradual completion verbs selected were less frequent with respect to the other verbs (see section 3). Thus, gradual completion verbs could be more impaired because of their lower frequency. However, this hypothesis has to be discarded, in so far as frequency did not affect E.Mi.'s performance on verbs of other categories.

The abstract/concrete dimension does not provide a satisfactory explanation, for Gradual Completions were not rated as more abstract than the other verbs used in the naming tests (States: 2.2; Punctuals: 3.8; Processes: 4.2; Accomplishments: 3.6; Achievements: 3.3; Gradual Completions: 3.4). Thus, the dissociation cannot be ascribed to a concreteness effect.

Similarly, the interference of agentivity can be ruled out. Gradual completion verbs can usually be classified as [+agentive] or [-agentive], depending on the subjects which they refer to. Gradual completion verbs were for the most part (5/6 considering the picture naming, 8/11 considering the naming from definition) classified as change of state verbs in the purely semantic classification. However, E.Mi.'s accuracy was roughly the same for change of state verbs and for verbs of other purely semantic categories, both in picture naming (change of state verbs: 10/17, or 58.8% correct; verbs of other semantic categories: 37/47, or 78.7% correct; $p > 0.05$) and in naming from definition (change of state verbs: 8/23, or 34.7% correct; verbs of other semantic categories: 25/62, or 40.3% correct; $p > 0.05$).

Thus, the dissociation reported cannot be attributed to any of the factors considered. However, considering the main characteristics of the gradual completion verbs selected, one may notice that many of them are morphologically complex (see fn. 10). In order to verify whether E.Mi. was sensitive to the actional features or to the morphological complexity of gradual completion verbs, two facts have to be considered: a) the distribution of morphologically complex verbs; b) E.Mi.'s performance on morphologically simple and morphologically complex verbs.

As to point (a), morphologically complex verbs were for the most part classified as gradual completion verbs. On the other hand, gradual completions were, for the most part, morphologically complex (see Table 5).¹⁷ This observation could be perfectly in line with the morphological account of the semantic dissociation.

Table 5

	Morphologically complex verbs on the total of gradual completions.	Gradual completions on the total of morphologically complex verbs.
Picture naming	4/6 (66.6%)	4/7 (57.1%)
Naming from definition	6/9 (66.6%)	6/11 (54.5%)

As to point (b), E.Mi. showed a striking preference for morphologically simple as opposed to morphologically complex verbs: the dissociation was significant collapsing the picture naming and the two naming tests together. In the naming from definition test, the pattern followed the same trend, the dissociation being only marginally significant probably because of the globally poorer performance (see Table 6).¹⁸

Table 6

	Correct percentage of morphologically simple verbs	Correct percentage of morphologically complex verbs	Chi-square test
Picture naming	46/57 (80.7%)	1/7 (14.2%)	$\chi^2 = 10.9, p = 0.0009$
Naming from definition	32/74 (43.2%)	1/11 (9%)	$\chi^2 = 3.37, p = 0.06$
Naming tests together	78/131 (59.5%)	2/18 (11.1%)	$\chi^2 = 13.04, p = 0.0003$

Furthermore, although the responses to the morphologically complex targets *affondare* 'to sink' (picture naming) and *appartenere* 'to belong' (naming from definition) were scored as correct, the two verbs were substituted with acceptable periphrases: respectively with *va a fondo* 'goes to the bottom', and *essere proprio* 'to be one's own'.¹⁹

E.Mi. participated in a morphological test, in order to investigate his morphological ability in more detail. Noun-verb pairs divided into three groups were used as targets. The pairs of groups (1) and (2) were morphologically related; group (3) pairs were only semantically related (e.g. *pistola* ~ *sparare* 'gun' ~ 'to shoot'). Moreover, the morphological relation was transparent (group 1: e.g. *zappa* ~ *zappare* 'hoe' ~ 'to hoe') or non-transparent (group 2: e.g. *piède* ~

pestare 'foot' ~ 'to tread').²⁰ Thus, group (1) pairs were labelled 'morphologically transparent', as the root remained unchanged, and the direction of the derivation process could be easily identified (Dressler 1985). As for group (2) pairs, the root appeared under different allomorphs, the morphological relation being often recognizable from only a diachronic perspective.²¹ Group (3) pairs lacked any morphological relation, but verbs denoted actions typically connected with objects which the corresponding nouns referred to. The frequency was matched across groups. Each group contained 10 pairs. For each pair, one picture was realized. E.Mi. was presented with the pictures two times: the first time he was requested to name the object which the examiner pointed at; the second time he was requested to provide the verb corresponding to the depicted action. E.Mi.'s performance is summarized in Table (7).²²

Table 7

Syntactic category	Group	Correct responses
Nouns	1 (transparent relation)	10/10 (100%)
	2 (non-transparent relation)	10/10 (100%)
	3 (no morphological relation)	10/10 (100%)
Verbs	1 (transparent relation)	8/10 (80%)
	2 (non-transparent relation)	2/10 (20%)
	3 (no morphological relation)	10/10 (100%)

Thus, E.Mi.'s performance varied with respect to the syntactic category (nouns: 30/30, or 100% correct; verbs: 20/30, or 66.6% correct; $\chi^2 = 9.72, p = 0.001$); verbs being significantly more impaired than nouns. Furthermore, E.Mi. showed a 'group-effect': he made far more errors on group (2) verbs ($\chi^2 = 15.6, p = 0.0004$), in comparison to verbs in the other groups.

To summarize, E.Mi. suffers from a severe morphological deficit, especially involving morphological complexity and non-transparent (in the meaning used here) morphology.

The correlation between morphological complexity and non-transparent morphology is straightforward. The production of prefixed and parasynthetic verbs often requires in Italian the application of phonological readjustment rules in order to correctly combine the

prefix (or the first part of the circumfix, in the case of parasynthetic verbs) with the verb stem. In the case of non-transparent morphology, the stem always undergoes a modification in the derivation process. A residual amount of morphological abilities would guarantee to E.Mi. the correct retrieval of morphologically complex words when the combination of stem and affix is completely transparent. However, compositional access is likely to fail when the combination of stem and affix gives rise to phonological modifications.

Turning back to the difference between gradual completion vs. other actional categories emerging from the naming tests, there is very good evidence that it is an artifact, due to E.Mi.'s morphological impairment. In fact: a) gradual completion verbs were, for the most part, morphologically complex; b) E.Mi. suffers from a severe morphological deficit, especially involving morphological complexity and non-transparent morphology.

Grammaticality judgement task: telic vs. atelic verbs

E.Mi. showed a striking difference between telic (relatively preserved) and atelic verbs (selectively impaired) only when producing grammaticality judgements. Atelic verbs were more difficult for controls, but E.Mi.'s performance must be considered pathological, in so far as the difference between the two categories of telics and atelics (29.2) overcomes the established threshold (20.75).

However, on the basis of the established parameters process verbs (the only atelic verbs used in this test) were syntactically more complex (see section 3). Thus, it is difficult to attribute the patient's pathology to a syntactic deficit (atelic verbs are more impaired because process verbs have a higher syntactic complexity) or to an actional deficit (atelic verbs are more impaired because the patient is sensitive to actional factors).

The question remains controversial, the truly actional account of the telic/atelic difference being theoretically possible, even if E.Mi. was not sensitive to the telicity feature in the other production or comprehension tasks.

However, the syntactic account of the observed difference is more supported by the general pattern of E.Mi.'s performance.

First of all, E.Mi. was non-fluent, and hardly able to produce complete and correct sentences in spontaneous speech. Second, the patient could not perform the gap-filling task, probably because of its high syntactic complexity.²³ Thus, the patient might be unable to understand the meaning of the whole sentence, at the same time filling the gap with a verb syntactically consistent with the given context.

E.Mi.'s syntactic difficulties may account for the telic/atelic difference in grammaticality judgements. If the hypothesis is correct, the actional effect is an artifact, dependent on the high syntactic complexity of process verbs.

5. General discussion

The main results can be summarized as follows:

- 1) In oral production of verbs in isolation, C.De. showed both an actional and a purely semantic dissociation, with process and movement verbs being relatively preserved with respect to other categories. However, there is good evidence that the two kinds of dissociations may be attributed to a concreteness effect, where process and movement verbs were preferred because of their higher concreteness value;
- 2) E.Mi.'s performance was characterized by: a) a disadvantage for gradual completion verbs with respect to verbs of other actional categories, in oral production of verbs in isolation; b) a telic/atelic difference in grammaticality judgements. As for (a), the actional effect is probably an artifact due to the patient's morphological deficit, gradual completion verbs being for the most part morphologically complex. As for (b), the issue is more controversial. However, there is some evidence supporting a syntactic account of the telic/atelic difference, for Processes (the only atelic verbs used in this test) were syntactically more complex with respect to verbs of other actional categories.

Thus, apparently actional and purely semantic effects may often be ascribed to (or may interfere with) heterogeneous factors, such as morphological complexity, syntax, and semantics (in a broad sense). Such a claim is not surprising, as the overlapping of deficits and artifactual effects have often been reported in the neuro-linguistic literature.

However, encouraging data about verb actionality in aphasia exist. Thus, the actional value of the verb may influence aphasics' performance. The most relevant case is that of G.Sc. (Finocchiaro 1999; Finocchiaro & Miceli, in preparation). She showed a dissociation between States (relatively preserved) in comparison to verbs of the remaining actional categories (significantly more impaired). On the other hand, the purely semantic classification failed to show any clear effect in the patients examined. The only patient who seemed to be sensitive to purely semantic values was C.De., but, as shown,

C.De.'s preference for movement verbs was probably due to a concreteness effect. However, these findings do not lead to the necessary conclusion that the purely semantic categorization has no psychological relevance. At least two alternative hypotheses could account for the failure to demonstrate any purely semantic effect:

- a) the small number of patients examined. Thus, the possibility of purely semantic effects cannot be ruled out in principle;
- b) the specific categories assessed. It could be the case that the semantic categories here are not relevant for the cognitive classification of verbs, although the purely semantic method per se is essentially correct. According to this hypothesis, by dividing verbs into different semantic classes, it should be possible to find out purely semantic dissociations in aphasia. One could select, for instance, some other classes individuated by Levin (1993), without considering their syntactic import (see section 2). Otherwise, the lexical semantic approach may offer some suggestions. Miller & Fellbaum (1991) chose to represent verb meanings in terms of the semantic relations (entailment, tropyonymy; cause; opposition; synonymy) by which they are linked. Thus, they classified English verbs into 14 semantically coherent groups of action and event verbs (e.g., bodily care and functions; cognition; emotion; perception; consumption; communication; motion; possession) and 1 group of state verbs.

Obviously, we need further evidence to discriminate among these possibilities. One might hope, though, that the arguments discussed here would help us find a set of useful tools in order to achieve greater accuracy in evaluating aphasics' performance on verbs.

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¹ As to the Noun/Verb distinction, see Haggège (1984), Hopper & Thompson

(1985), Schachter (1985), Langacker (1987), Miller & Fellbaum (1991), Lazard (1999). As to their different concreteness degree, see Chiarello et al. (1999).

² With the label 'purely semantic', I refer to a type of non-actional classification entirely based on empirical factors. For a more detailed explanation, see the next section.

³ For the gradual completion verbs, see Bertinetto & Squartini (1995).

⁴ The signs (+) and (-) in the gradual completion verb column indicate peculiar and non-univocal behaviours: gradual completion verbs, in contrast to the other verb categories, are all compatible, in Italian, with adverbs like *'di molto, di poco, di parecchio'*; for the rest, they are generally similar to accomplishments. However, many gradual completion verbs may also refer to the final point of a process, taking on an achievement sense: consequently, in these cases they react as achievements do to the syntactic test.

⁵ Only non-permanent states admit durative *'per x tempo'*. Only *'reversible'* achievements admit *'per x tempo'* to mark an 'inversion'.

⁶ *'Di molto'* and *'di parecchio'* could be translated in English as 'by a lot', and *'di poco'* as 'by a little'. However, these adverbials are less commonly used than the Italian counterparts.

⁷ The marginal cases, in which Achievements may take on the progressive form with the durative meaning, have been neglected here.

⁸ Classes (3) and (4) can be divided into the following sub-classes: 3a) Psychological verbs (e.g. *to love*); 3b) Perception verbs (e.g. *to notice*); 3c) Verbs of cognitive activities (e.g. *to read*); 4a) Verbs of sound emission (e.g. *to twitter*); 4b) Verbs of light emission (e.g. *to flash*); 4c) Verbs of smell emission (e.g. *to smell*); 4d) Verbs of substance emission (e.g. *to sweat*); 4e) Communication verbs (e.g. *to phone*).

⁹ The lemma frequency of the verbs (i.e., the cumulative frequency of the inflected and the inflected forms) was considered.

¹⁰ Importantly, gradual completions were morphologically different with respect to the other verbs, as they were, for the most part, morphologically complex (i.e. prefixed or parasynthetic).

¹¹ The opposition, within intransitive verbs, between unaccusatives and unergatives is based on the assumption that the single (inner) argument of an unaccusative verb is an object at the deep structure level, while the single (external) argument of an unergative verb is a subject at the deep structure level (Perlmutter 1978; Levin & Rappaport Hovav 1995; Sorace 1995; Cennamo 1998). For a semantic approach to the unaccusativity, see Van Valin (1990).

¹² The whole battery also comprehended a gap-filling test, not submitted to C.De. and E.Mi. because they were unable to carry on the requested task.

¹³ Controls were submitted to the whole battery of tests in this order: 1) Picture naming; 2) Naming from definition; 3) Gap-filling; 4) Grammaticality judgements; 5) Morphological task. The order of the stimuli within each test remained unchanged for patients and controls.

¹⁴ Breedin et al. (1998) showed that the concrete/abstract dimension might play an important role also on verb retrieval.

¹⁵ The telic/atelic difference can be easily explained. In fact: 1) the atelic verbs used in this test are all Processes, and Processes are, on the basis of the established parameters, syntactically more complex with respect to the other verbs; 2) syntactic ability has the major role in grammaticality judgements.

¹⁶ C.De. was unable to carry on the gap-filling task. Thus, as to C.De.'s ability in orally producing verbs in context, no data are available.

¹⁷ The remaining morphologically complex verbs were quite uniformly distributed across actonal categories.

¹⁸ Parasynthetic and prefixed verbs have been considered together. For parasyn-

