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Author(s): Carlo Semenza, Brian Butterworth, Marta Panzeri, and  
Margarete Hittmair-Delazer

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## DERIVATIONAL RULES IN APHASIA

Carlo Semenza\*, Brian Butterworth#, Marta Panzeri\*,  
Margarete Hittmair-Delazer \*,\*\*

\* Università degli Studi di Padova

# University College London

\*\* Univ. Klinik für Neurologie, Innsbruck

In this paper we present evidence from aphasic speech that people possess both knowledge of derivationally complex words and knowledge of the rules for constructing such words. This may not be surprising, but it has proved remarkably difficult to demonstrate this separation by the methods of linguistic analysis or by the methods of normal psycholinguistics. (See Butterworth, 1983, for a review of this issue). For the psycholinguist, when a word is produced as part of normal discourse, or, indeed, in response to some experimental manipulation, it is unclear how one can tell whether it was retrieved as a whole from a mental lexicon or constructed on-line according to rules. The mere fact of rule-like regularities in the lexicon does not of itself distinguish between the separate status of the rules from rules as emergent properties (as connectionists have suggested). Experiments on normals designed to elicit rule-governed nonce-formations can at best show that some (productive) patterns can be exploited in special cases.

Neuropsychological methods, on the other hand, may allow us to slash through this gordian knot with the sword of selective impairments. If it can be shown that brain-damage may selectively impair knowledge of words, for example, while leaving knowledge of rules intact, then this would be the first half of a strong case for the separate representation in the brain of the two kinds of representation. The second half is to find patients with spared vocabulary but impaired knowledge of rules. Neuropsychological phenomena enjoy a particular epistemological status because they are neutral with respect to the expectations of the observer and indeed sometimes counterintuitive. It has been shown for example, that the production of different categories of nouns can be selectively affected in a way that leaves only one category intact; the same category selectively impaired in one patient may be selectively spared in another.

The clearest and cleanest instance is that of proper names: Patients have been described with extremely severe proper name anomia while the use of common nouns has been spared (Semenza and Zettin, 1988; 1989); at the same time, other patients have demonstrated the sparing of proper names in various naming conditions and in otherwise entirely meaningless spontaneous speech (Semenza and Sgaramella, 1991). This sort of phenomenon forces us to seek explanations in independent processes for different categories of words. More relevant to the present issue is the support for the independence of stems and inflections shown by patients correctly inflecting nonce-forms according to the grammatical context (e.g. Caplan, Kellar and Locke, 1972); and, as is well known, some, so-called "agrammatic", patients show the opposite pattern

where the deficit afflicted inflections but not stems (e.g. Goodglass, Gleason, Ackerman-Bernholtz and Hide, 1972).

We present here some evidence for the sparing of two types of derivational process in patients where wordfinding is severely impaired. The first type is the spared use of derivational affixation in nonce-formation in the spontaneous speech of Italian jargonaphasics. The second type is the experimental elicitation of compounds in German patients, also with severe word-finding problems.

### **Derivational affixation in nonce-formation in spontaneous speech**

In the first systematic analysis of derivational morphology in aphasic speech, we showed that three patients were able to construct nonce-forms using a wide variety of derivational rules. (Previous works provided some support for the separability of derivational and inflectional morphology in comprehension, e.g. Tyler and Cobb, 1987). After suffering an injury to the posterior portions of their left hemisphere they had fluent, well articulated but unintelligible speech, containing semantic errors and neologisms. Neologisms were constructed in three distinct ways:

First, like other aphasics, they used legal concatenations of phonemes to form neologistic stems, which were then inflected according to the context.

(1) *misecca italiana* (Italian, f.s. adjective)

*a* in *misecca* is the ending marking an f.s. noun. (We collected overall 152 items of this kind.)

Second, they used real roots in combination with real derivational suffixes and/or prefixes, as well as inflections that were typically appropriate (63 items).

(2) *fratellismo*

a compound of the real stem *fratell(o)* [brother] and the real suffix *-ismo*. There exists the real word *fratellanza* [brotherhood].

(3) *migliarie*

a compound of the real stem *migli(a)* [miles] and the real suffix *arie*.

(4) *affuocato*

a real root, *fuoc(o)* [fire], with a real prefix, *a-*, and a real suffix, *-ato*. The doubling of *f* is rule-governed and hearable by Italian subjects.

In the third, they used a neologistic root in combination with a real derivational affix (83 items).

(5) *tutto il [all the] ternessico che mi aspetta [that waits for me]*

*terness(o)* is a neologistic root which, coupled with the real suffix *-ico* fits the grammatical structure of the sentence.

In these patients, sensitivity to the grammatical category was largely spared: of the derivational neologisms whose intended category was uniquely determinable from the context, 91% were appropriate: so a verb would be constructed where a verb was needed in the current sentence context, a noun when a noun was needed, and so on.

### **Productivity**

We analysed the range and type of morphological affixes. Affixation types in the real words used by the patients was compared with the affixation types used to form neologisms: similar ranges were found in the two cases:

#### Suffixation:

- (6) *assaggiamento* noun forming  
*assaggi(are)* [to taste] + *mento* [+ment]
- (7) *sogillare* verb forming  
 [neologistic root] + *are* [infinitive]
- (8) *macchinarico* adjective forming  
*macchinari(o)* [machinery] + *ico*
- (9) *atamente* adverb forming  
 [neologistic root] + *mente* [+ly]

#### Prefixation:

- (10) *bilungo*  
*bi* [bi] + *lungo* [long]

We also compared the use of affixes traditionally classified as more productive with those classified as less productive in Italian. If the patients had retained control only of rules for forming new words, then a great preponderance of affixation types in neologisms should be productive; on the other hand, if they retained control of rules for analyzing the whole of the language vocabulary, then there should be no such preponderance.

The incidence of a group of affixes considered as the most productive in Italian (see Dardano, 1978) over all affixes used by each patient in the production of both neologisms and real words was therefore calculated. In all patients the majority of affixations were classified as *non-productive* and, in two out of three, the proportion of productive types in neologisms was statistically indistinguishable from the proportion used in real words (for further information see Semenza, Butterworth, Panzeri and Ferreri, 1990: Panzeri, Semenza, Ferreri and Butterworth, 1990).

## Compounding

We present here some preliminary evidence that German speaking aphasics can use compounding rules to produce nonce-forms when they are unable to find the target words. Compound words are much more frequent in German than in English or Italian. Therefore we sought evidence for compounding rules from German speaking aphasics. Rather than use spontaneous speech, an experimental task was administered to elicit compounds. A picture naming task was given to fifteen German speaking aphasics. The test included items whose name was either a compound or a monomorphemic word. (Further information is available in Hittmair-Delazer, Andree, Semenza, De Bleser and Benke, in preparation).

The analysis of the different error types indicates that the patients often retain control of morphological knowledge despite disrupted lexical abilities. An interesting finding was that pictures whose normal name was a compound tended to elicit compound neologisms. There was no apparent reason in the pictures themselves, since these pictures may well have monomorphemic names in other languages. It seemed that, paradoxically, the patients could often retrieve information that the target was a compound, though the word itself was inaccessible. These compounds came in four main varieties :

### Neologistic noun-noun compounds

	<u>Target</u>	<u>Response</u>
(11)	<i>Taschenlampe</i> pocket light [torch]	<i>Lichtflamme</i> light flame
(12)	<i>Rosenkranz</i> roses crown [rosary]	<i>Herzkreuz</i> heart cross

### Neologistic compounds with one part of the target

Here one component of the target is substituted, the other named correctly. First and second part of the compound are equally often substituted. The correct part keeps its position in the paraphasia.

(13)	<i>Schneemann</i> snowman	<i>Schneefrau</i> snow woman
(14)	<i>Windmühle</i> windmill	<i>Schneemühle</i> snow mill

Verb-noun compounds

Patients seem to construct or choose their compounds so as to respect the grammatical and morphological character of the components in the target word.

- |      |  |   |
|------|--|---|
| (15) | <i>Rollschuh</i><br>roll [V] shoe[N]<br>[a roller skate] | <i>Tretkarren</i><br>tread[V] carriage[N]<br>[neologism]          |
| (16) | <i>Dosenöffner</i><br>cans[Npl] open[V+er]               | <i>Schraubenzieher</i><br>screws[Npl] pull[V+er]<br>[screwdriver] |

Semantic paraphasias

These are real words that respect the compound nature of the target.

- |      |  |  |
|------|--|--|
| (17) | <i>Eichkatzl</i><br>oak kitten<br>[squirrel]         | <i>Haselnuss</i><br>hazel nut            |
| (18) | <i>Salzstreuer</i><br>salt spreader<br>[salt cellar] | <i>Zuckerdose</i><br>sugar jar           |
| (19) | <i>Aschenbecher</i><br>ash bowl [ashtray]            | <i>Feuerzeug</i><br>fire stuff [lighter] |

**Conclusion:**

These data suggest that brain damage can selectively impair word-finding such that patients will resort to derivational rules to construct a substitute for the intended word. This, of course, is possible for the speakers only if the rules have a neural implementation that is separable from the implementation of words. Of course the data presented here is at best fragmentary but it does illustrate the way in which neuropsychological methods can be focussed on issues of concern to linguists interested in morphology.

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