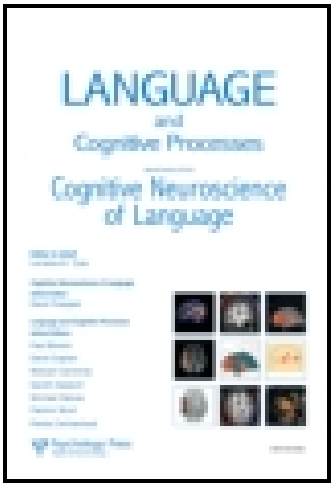

Language and Cognitive Processes
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/plcp20

L'orange, c'est le fruitier de l'orangine: A case of morphological impairment?

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Published online: 13 Dec 2007.

To cite this article: Agnesa Pillon , Marie-Pierre de Partz , Anne-Marie Raison & Xavier Seron (1991) L'orange, c'est le fruitier de l'orangine: A case of morphological impairment?, Language and Cognitive Processes, 6:2, 137-167, DOI: 10.1080/01690969108406941

To link to this article: http://dx.doi.org/10.1080/01690969108406941

LANGUAGE AND COGNITIVE PROCESSES, 1991, 6 (2) 137–167

L'orange, c'est le fruitier de l'orangine: A Case of Morphological Impairment?

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In this paper, we report the case of a patient who produced many errors in productive tasks that are analysable as a function of morphological properties of the target and/or the response. We propose a quantitative and a qualitative analysis of the derivational errors produced in a picture-naming task, in order to determine whether these errors result from a morphological impairment. The analysis is conducted with reference to minimal predictions that can be inferred from current models of morphological decomposition. It is shown that the morphological errors made by the patient are explainable without appealing to a morphological organisation of the lexicon. More precisely, we account for these errors in the context of a general two-stage retrieval mechanism that applies both to affixed and unaffixed words.

INTRODUCTION

Word-finding difficulties are very common in aphasia. Depending on the stages of word retrieval and production that are impaired, these difficulties lead to different patterns of word production errors, especially in picture-

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We would like to thank Pierre Feyereisen, Marie-Louise Moreau, Tim Shallice, Brian Butterworth and two anonymous reviewers for their helpful comments on an earlier draft of the manuscript.

naming tasks. These patterns evidence a particular combination of semantic, phonemic and visual paraphasias, partial attempts and refusals to name, neologisms and multiword circumlocutions.

A French-speaking patient (J.P.C.) was referred to the Cliniques Saint-Luc, Brussels, for therapy. His word-finding difficulties gave rise to exceptional linguistic behaviour in spontaneous speech as well as in picture naming, i.e. he produced many apparent derivational errors. In the course of the various examinations and therapy exercises, we collected a corpus of 575 errors and noted that 143 of them (25%) could be analysed as a function of morphological principles. The majority of these derivational errors (76%) consisted of suffix addition (1 and 4), omission (2) or substitution (3 and 5), sometimes leading to a word response (1–3) and sometimes not (4–5). The other errors were stem substitutions, the affix being correctly produced (6 and 7).

	Target	*Response*
1.	parachute (parachute)	parachut*isme*[1] (parachuting)
2.	tambour*in* (tambourine)	tambour (drum)
3.	bouill*oire* (kettle)	bouill*otte* (hot-water bottle)
4.	valeur (value)	*valeur*ité*
5.	accoud*oir* (armrest)	*accoud*eur*
6.	pomp*iste* (pump attendant)	garag*iste* (garage owner)
7.	min*eur* (miner)	*charbonn*eur*

While many derivational errors were noted in connected speech samples (as were the errors "fruit*ier*" for "fruit" and "*orang*ine*" for "orang*er*," quoted in the title), we will only present here a detailed analysis of the pattern of errors J.P.C. produced on a more controlled task, i.e. the picture-naming task.

The originality of this case and the relevance of presenting such an analysis deserve explanation. First, there is no other case report in the literature of a patient producing *derivational* errors in *picture naming*. Lecours, Dordain, Nespoulous and Lhermitte (1979) and Lecours (1982) reported derivational errors (note that the same patient, General X, was studied in the two reports), but these errors were produced in spontaneous speech. Therefore, it is generally impossible to specify the speaker's targets or to be sure that there were conventional targets behind the patient's derivational errors (Lecours, 1982, p. 228). Furthermore, some of the

[1]In order to facilitate reading for non-French speakers, we have adopted two conventions: (1) we have transcribed the targets and responses orthographically rather than phonetically, the transcriptions being based on French spelling regularities; (2) when words, either target or response, are morphologically analysable, we have italicised the affix.

paraphasias reported were produced by syntagmatic contaminations. Apart from this case, only cases of deep dyslexic patients producing derivational errors in oral reading tasks have been reported (Coltheart, Patterson & Marshall, 1980; Job & Sartori, 1984; Patterson, 1980; 1982). Secondly, in the context of the current debate in psycholinguistics and neuropsychology on the representation of morphological knowledge, data on the production of derived words are very scarce. Most studies have focused either on the mechanisms involved in the lexical access of visually presented inflected or derived words (see Henderson, 1985, for a review) or on the production of inflected words (Butterworth, 1979; Caramazza, 1988; Garrett, 1980; 1982; Miceli & Caramazza, 1988; Stemberger & MacWhinney, 1986).

What is precisely the goal of the analysis we developed regarding J.P.C.'s error pattern? At first sight, the mere existence of a patient producing suffix and stem additions and substitutions might be considered as critical evidence for lexical stems being stored and selected independently of derivational morphemes, and for the two morpheme types having to be combined in some way during production. What would be impaired, then, would be a processing component that handles such combinations. However, just as it is insufficient to note grammatical disturbances in the speech output of a Broca's aphasic to conclude that the impaired language mechanism lies in a syntactic component, the surface morphological properties of errors do not suffice to settle the issue of the impaired psycholinguistic mechanism that gives rise to them.[2] Thus, we need a framework of analysis that will allow us to establish whether the apparent derivational errors produced by J.P.C. actually resulted from an impairment of specific derivational processes (i.e. whether they are true derivational errors), or, more generally, whether these errors somehow reflect derivational principles of organisation in the lexicon. The aim of the present paper is to propose such a methodological framework through a detailed analysis of J.P.C.'s naming errors.

Underlying the analysis will be the general assumption that naming errors should show particular features under conditions of damage to the morphological component of the lexicon. These features may be related to overall naming performance on the one hand, and the detailed pattern of derivational errors on the other.

General features of naming performance may indeed be relevant in determining whether or not derivational errors do result from damage to

[2]See Caramazza (1988) for a discussion about the ambiguity of morphological reading errors in patients with acquired dyslexia. See also Badecker and Caramazza (1987) and Funnell (1987) for analyses of morphological paralexias that did not turn out to be the result of a morphological impairment.

the morphological component. The comparison of the overall naming performance for unaffixed and affixed words will provide information about a possible dissociation in naming between affixed and unaffixed words. If the patient is solely impaired in naming affixed items but performs normally with unaffixed items, this would be a first argument in favour of the derivational impairment hypothesis. Then, if the number of naming errors did not differ for the two word types, consideration of the nature of naming errors produced with unaffixed and affixed words will provide cues for determining whether errors result from two distinct impairments, affecting whole-word retrieval mechanisms with unaffixed words, and derivational mechanisms with affixed words.

As for derivational errors, if they actually originated from an impaired morphological component, then they can be expected to exhibit features reflecting the nature of the operations processed by this component. In order to determine what these features might be, we need a sufficiently detailed characterisation of the morphological component. Unfortunately, current models that assume the involvement of such a component in the processing of derived words are underspecified as regards the nature of the derivational operations.

For instance, Garrett (1980) has argued that normal speech errors demonstrate that retrieving stems is a process independent from the processes that add affixal morphemes (inflectional and derivational) to stems. However, the evidence presented essentially relies on errors involving inflected words, and the possibility is only briefly considered that these processes might involve derivational affixes. Furthermore, as Garrett's (1980) work primarily concerns sentence production processes, the demonstration focuses on the fact that these processes first select stem forms and that affixes are added to stems at a later stage in sentence production. But there is no mention about the way these affixes would combine with stems in single-word production.

Based on an experimental study in which the subjects were presented with verbs auditorily and had to produce a related noun as quickly as possible, MacKay (1978) argued that the lexicon contains a derivational component used for retrieving all complex words. Within this derivational component, stems are stored together with a semantic formative (the inherent feature [+ Verb]) and an abstract rule marker, which calls up the rules for altering the stem and adding the independently stored affix. However, it is questionable whether results obtained from such an explicit derivational task can be generalised to normal processing of derived words. Moreover, it seems unlikely that such a model could account for the production of many English or French complex words: There are many instances of semantic and morphophonemic unpredictability, especially for derived words, where word formation cannot be described by rules. In our

view, a model of word production is tenable only under the condition that it makes a functional distinction between regularly and irregularly affixed forms.

This requirement has been emphasised by Bybee (1985) together with the need to distinguish between frequent and infrequent derived words. Combining data on language acquisition, adult language processing, cross-linguistic comparisons and historical change, Bybee proposed a model of lexical representation of morphologically complex words in which regularity and word frequency are two relevant factors in determining the autonomy of lexical representation. High-frequency morphologically complex words and irregular morphologically complex words have their own lexical representations; only morphologically complex words that are regular and not of high frequency do not have their own representations and are retrieved both from their base form and from the affix. Derived forms are then assumed to have their own lexical entry, when they are semantically and/or morphophonemically unpredictable; that is, when they are not derivable by general semantic, morphological and phonological rules from some other word or stem.

Thus, the regularity and frequency distinctions can be considered as minimal theoretical constraints for models of morphological processing and are retained for our purpose of determining which features should exhibit the pattern of derivational paraphasias to be viewed as resulting from a morphological impairment. Because we hypothesise that only regular and infrequent derived targets have to be processed through a morphological device, then only derivational paraphasias noted for such targets of our corpus should be accounted for as resulting from a morphological deficit. Moreover, we should find qualitatively different errors for high-frequency and irregular words, as these words are assumed to be processed by a whole-word mechanism.

A further prediction concerning the nature of errors a morphological deficit would produce can be drawn from the hypothesis of Morton and Patterson (1980) for morphological paralexias produced by dyslexic patients (Job & Sartori, 1984; Patterson, 1980; 1982). Morton and Patterson (1980) argued that the fact that patients, when they produce incorrect affixes, always produce appropriate affixes (legitimate for that base morpheme), can be taken as evidence that, at the level of *output* logogens, each base morpheme has stored with it a list of legitimate affixes. Thus, in this view, while the units of representation are stems, all possible combinations are listed in the lexicon. A morphological impairment would then lead to the substitution of derivational affixes *within* the derivational paradigm of a base word. We can predict on the basis of this theoretical constraint that affix substitutions should never lead to nonword responses.

So far, we have detailed a set of features that naming errors should

exhibit in case of impairment to the morphological component of the lexicon. To preclude any ambiguity, we still have to make clear that all these features are expected to be found in erroneous responses produced for *existing* or already known items. The specifications of the morphological component that we discussed above relate indeed to the processing of existing derived words, which are assumed to be retrieved by applying appropriate derivational rules to base morphemes. The above discussion does not concern the processes involved in the production of *new* derived words or nonce-forms, which probably call up distinct rules (MacKay, 1978; 1979). Thus, by "morphological impairment" we mean the disruption of the rule-governed mechanisms that handle the combinations of base and affixal morphemes in order to produce attested derived words (and, particularly, those that are infrequent and regularly derived).

Before presenting the investigation carried out on the basis of the methodological and theoretical principles we have now specified, we will first provide a survey of the patient's medical history and performance on various neuropsychological and language tests, and then describe the linguistic material we used to test J.P.C.'s naming performance and the general content of the corpus of errors.

CASE SUMMARY

The patient, J.P.C., was a right-handed 33-year-old Belgian male. At the time of his accident, he worked as a car sales representative. J.P.C.'s mother tongue was French, but he also knew some English, Dutch, German and Italian.

In April 1986, he suffered brain damage in a car accident. A CT scan showed a left temporo-parietal, extra-dural haematoma as well as a compound fracture and a left temporo-cerebral contusion under the haematoma. The haematoma was surgically evacuated and the temporo-parietal compound fracture was set. Three days later, a CT scan showed the complete evacuation of the haematoma.

In June 1986 (2 months post-onset), J.P.C. started language therapy at the Cliniques Saint-Luc. At this time, his spontaneous speech was fluent, close to jargonaphasia, and marked by word-finding difficulties and paragrammatism. His picture naming was severely disturbed (55% errors), and we noted a clear effect of target frequency on performance (J.P.C. made 4/15, 6/15 and 11/15 errors for high-, medium- and low-frequency words respectively). His oral comprehension, though not perfect, was considerably better than his expression (a French adaptation of the Token Test gave scores of 8/10, 8/10, 4/10, 6/10 and 9/20 respectively, for the five levels). J.P.C.'s written language was less severely impaired than his oral language. In spontaneous writing, some paragrammatic sentences and

neologisms were observed. His reading showed formal and phonemic paralexias and some regularisations of pronunciation for irregular words. His performance in reading comprehension strictly paralleled those observed in the oral modality.

J.P.C. was also administered a semantic battery (Bachy-Langedock, 1987) that concerned various semantic relations (Chaffin & Herrmann, 1984). J.P.C. performed correctly on a categorisation task with inclusive relations with pictures (24/24) and written words (35/36). He also performed satisfactorily on different tasks concerning attributive relations: for whole/part relations, he obtained a score of 15 out of 15 with pictures and 15 out of 19 with written words; for action/object matching, his performance was perfect with pictures and also with written words (19/19). The patient also correctly performed a serial and hierarchised classification task (17/17) and a task involving the processing of relations between various possibilities (31/32). In conclusion, J.P.C. did not present any major disorder in semantic processing.

The initial diagnosis was Wernicke's Aphasia evolving towards amnesic aphasia. After these evaluations, J.P.C. received therapy sessions for 6 months, twice a day. Significant improvement of his spontaneous speech was achieved in 6 months: his fluent verbal output was no longer jargonaphasic and became more informative, but word-finding difficulties still remained. In the picture-naming task, his performance improved from 55% errors to 24% errors and remained related to word frequency. An improvement was also noted on the Token Test (J.P.C. performed normally on the first three levels and on levels IV and V his scores were 8/10 and 15/20 respectively). In writing, his performance was perfect on all directed tasks, but spontaneous writing still showed paragrammatism. Reading sentences and texts led to some visual and phonemic paralexias. His reading comprehension turned out to be almost normal.

In April 1988, J.P.C. was presented with a controlled repetition and reading task designed to measure his capacity to treat morphologically complex words. The word lists contained 210 monomorphemic words matched for grammatical category, letter length and token frequency with 210 derived words. The patient made no repetition errors. In reading aloud, his performance was almost similarly impaired for both word types: we noted 23 errors (11%) with monomorphemic words and 26 errors (13%) with derived. Only nine reading errors were analysable as possible derivational paralexias.

THE CORPUS OF ERRORS

We will analyse the pattern of errors in naming pictures through J.P.C.'s responses to a subset of Bachy-Langedock's (1987) Naming Battery and of the standard naming task usually used at our centre. From these batteries,

we only used responses whose targets were monomorphemic words and derived words composed of a free stem + an affix (prefix or suffix). Thus, in order to homogenise the category of morphologically complex targets, we disregarded the compounded targets and the affixed targets consisting of a bound stem + an affix.[3]

All the target words were concrete nouns that were only derived, i.e. they did not contain any inflectional affix: They were all singular forms and none presented an ending that would vary according to number (such as French words ending with /al/ which form their plural by substituting /al/ with /o/). However, the derived targets we used did not constitute a homogeneous category as regards their transparency (their semantic and morphophonemic regularity) and their affix productivity.

The subset we considered contained 260 items. Target length varied from one to four syllables. Their frequency was determined according to Vikis-Freiberg's (1974) list (token frequency). The targets were then categorised into high-frequency words ($\geq$20 in a list of 125,000 words; mean frequency for monomorphemic words = 136, for derived words = 81), medium-frequency words ($20 > fq > 1$; mean frequency for monomorphemic words = 3, for derived words = 3) and low-frequency words (unlisted words).

The distribution of targets regarding different categories of length, frequency and morphological structure is displayed in Table 1 (see "Number of items"). Note that, in this table and in the paper, we refer to monomorphemic and derived targets as "unaffixed" and "affixed" targets respectively.

J.P.C. was tested three times with this battery over a 20-month period: the first examination (E1) took place 2 months after the stroke (June 1986), the second (E2) after 9 months (January 1987) and the third (E3) 2 years (April 1988) after the stroke. Thus, J.P.C. was tested on 3 × 260 items (780).

The corpus of errors amounts to 317 (41%) if only the first responses are considered. There were also 225 erroneous productions in the self-correcting sequences. In all the *qualitative* analyses below, i.e. analyses of error types, these 225 erroneous productions will be considered together with the 317 errors produced as first responses (total errors = 542).

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[3]Bound stems are word bases that cannot stand alone as words (e.g. *suade* in *persuade* and *dissuade*). They are opposed to free stems, which can be used as word units (e.g. *friend* in *friendly*). Bound and free stems differ in many respects in French. Among other things, bound stems generally present more phonological and semantic irregularities when they combine with affixes, their proper meaning is often ambiguous, and they are rarely used for creating new words. We must mention that there is no general agreement among French linguists for considering words composed with bound stems as true affixed words. The reason why we disregarded these items in the analysis lies in this structural ambiguity.

TABLE 1
Number (*N*) and Percentage (%) of Naming Errors for Unaffixed and Affixed Targets, According to the Examination (E1, E2, E3) and to the Target's Frequency and Length

	Unaffixed Items						*Affixed Items*					
		E1		*E2*		*E3*		*E1*		*E2*		*E3*	
	No. of items	*N*	*(%)*	*N*	*(%)*	*N*	*(%)*	*No. of items*	*N*	*(%)*	*N*	*(%)*	*N*	*(%)*
High-frequency													
1-syllable	18	3	(17)	1	(6)	0	(0)	—	—		—		—	
2-syllables	12	2	(17)	3	(25)	1	(8)	4	0	(0)	0	(0)	0	(0)
3-syllables	7	0	(0)	1	(14)	0	(0)	7	6	(86)	1	(14)	1	(14)
Medium-frequency														
1-syllable	31	15	(48)	6	(19)	6	(19)	—	—		—		—	
2-syllables	46	22	(48)	15	(33)	5	(11)	24	18	(75)	11	(46)	4	(17)
3-syllables	16	12	(75)	5	(31)	2	(13)	10	8	(80)	5	(50)	5	(50)
4-syllables	—	—		—		—		1	1	(100)	1	(100)	1	(100)
Low-frequency														
1-syllable	18	13	(72)	9	(50)	8	(44)	—	—		—		—	
2-syllables	20	17	(85)	13	(65)	9	(45)	11	9	(82)	6	(55)	6	(55)
3-syllables	18	16	(89)	9	(50)	8	(44)	15	14	(93)	8	(53)	8	(53)
4-syllables	—	—		—		—		2	2	(100)	0	(0)	1	(50)
Total	186	100	(54%)	62	(33%)	39	(21%)	74	58	(78%)	32	(43%)	26	(35%)

ANALYSIS OF NAMING PERFORMANCE

In the Introduction, we proposed a set of criteria for determining whether or not the derivational naming errors produced by J.P.C. could be viewed as indicative of an impairment of derivational processes. The first three sections of the analysis aim to compare the patient's pattern of naming errors to the expected features of naming performance under conditions of derivational impairment. These features can be summarised as follows:

1. Naming is especially impaired with affixed targets, and performance is relatively normal with the unaffixed ones (this feature will be considered in the first part of the analysis).
2. Errors with unaffixed targets are qualitatively different from errors with affixed targets.
3. Derivational errors are only noted with regularly derived words of medium/low frequency and take the form of word responses.

Because only one subtype of derivational errors will be found to actually present features that are compatible with the hypothesis of derivational impairment, we will have to test and discuss alternative hypotheses to account for the production of derivational errors. This will be presented in the last two sections of the analysis.

The General Level of Performance to Unaffixed and Affixed Targets

Our purpose here is to determine whether performance on the naming task shows a dissociation between unaffixed and affixed targets. If word-finding difficulties were essentially associated with affixed items, a derivational impairment hypothesis would be supported.

The number and percentage of erroneous first responses produced in each of the three examinations as a function of the length, frequency and morphological structure of the target is presented in Table 1.

As Table 1 shows, J.P.C.'s word-finding problem was not confined to the production of affixed words. Thus, we evidently do not have a lexical deficit selectively impairing derivational processes. The question to be answered, then, is whether the deficit leading to erroneous naming of affixed targets is indeed distinct from the one leading to naming errors for unaffixed ones. We hypothesise that, if two distinct mechanisms were actually impaired, then we should observe some particular features differentiating in the general response pattern for these two word types.

With this line of reasoning, we contrasted the general level of performance to both types of targets as a function of several variables. If two

TABLE 2
Probability of an Erroneous First Response being Followed by a Self-correcting Sequence (P1) and for this Sequence to Lead to the Correct Response (P2) in the Three Examinations (E1, E2, E3)

	E1		*E2*		*E3*	
	Unaffixed	*Affixed*	*Unaffixed*	*Affixed*	*Unaffixed*	*Affixed*
P1	0.53	0.53	0.73	0.63	0.28	0.58
P2	0.25	0.29	0.40	0.70	0.36	0.27

different impaired mechanisms were involved, the general level of performance for affixed *vs* unaffixed targets might display

1. a differential pattern of improvement over time;
2. a differential effect of the target frequency and length;
3. a contrast in behaviour as regards the attempts made by J.P.C. to self-correct his erroneous responses;
4. a different probability for a successful self-correcting attempt;

Table 1 presents the data concerning the first two points and Table 2 the last two.

Apart from the fact that J.P.C. performed better with unaffixed targets on the whole than with affixed targets (but this difference reaches statistical significance only in E1: $\chi^2 = 7.44$, d.f. = 1, $P < 0.01$; E2: $\chi^2 = 0.46$, d.f. = 1, $P > 0.10$; E3: $\chi^2 = 3.8$, d.f. = 1, $P < 0.10$),[4] the data do not consistently indicate sharp contrasts between the derived and the non-

[4]To allow a proper comparison between unaffixed and affixed targets, we computed all statistics by considering only the results for the two- and three-syllable targets, because our material does not contain any affixed item of one-syllable length, and any unaffixed items of four-syllable length. We must point out, moreover, that the results of chi-square statistics have to be taken with caution, because of the unequal distribution of the 260 items into the various subsets defined by the crossing of the three parameters of length, frequency and morphological structure. To make an accurate evaluation of the independent effect each of the parameters has on performance, we should compare the level of performance of each subset with each other. However, this was not feasible, because the majority of these subsets contained too few items to allow chi-square statistics. Therefore, to compare the level of performance to affixed and unaffixed items, we had to group the results obtained for items of various length and frequency. To test the frequency effect, we grouped together the two- and three-syllable targets, and to test the length effect, we grouped the targets of high, medium and low frequency. By doing so, the effects of the three parameters and their possible interaction might be entangled. Finally, we tested the length and frequency effects by adding up the results obtained at the three examinations.

derived targets. First, parallel improvement is observed for the two target types (for affixed targets: $\chi^2 = 29.82$, d.f. = 2, $P < 0.001$; for unaffixed targets: $\chi^2 = 34.15$, d.f. = 2, $P < 0.001$). Secondly, there is a general tendency towards poorer performance when the frequency of the target decreases, for both affixed ($\chi^2 = 15.93$, d.f. = 2, $P < 0.001$) and unaffixed targets ($\chi^2 = 47.98$, d.f. = 2, $P < 0.001$) and no clear length effect is noted for either target type (for affixed targets: $\chi^2 = 3.13$, d.f. = 1, $P < 0.10$; for unaffixed targets: $\chi^2 = 2.99$, d.f. = 1, $P < 0.10$). Finally, there is no clear or consistent difference in the self-correcting behaviour of J.P.C. with respect to the morphological structure of the target: The probability of an erroneous first response being followed by a self-correcting sequence and for this sequence to lead to the correct response, seem to vary more as a function of the examination than of the target type.

Nevertheless, the clear effect of frequency of the target on naming performance provides at least some indication that J.P.C.'s word-finding difficulties are probably caused by a lexical, rather than a semantic, impairment, i.e. a difficulty in retrieving the word's phonological form from the semantic system rather than a difficulty in the semantic system itself. As an additional argument, J.P.C. did not present any disorder in semantic processing (cf. infra) in the semantic battery (Bachy-Langedock, 1987). Furthermore, J.P.C.'s frequent attempts to correct his responses (on average, 55% of the errors were followed by such an attempt) can also be considered indicative of a lexical impairment.

Obviously, the variables we have considered in this analysis do not provide any evidence that J.P.C.'s affixed-word processing was selectively impaired, or that two distinct word-retrieval impairments were behind the naming difficulties to affixed and unaffixed targets. But, so far, only quantitative data – the total number of errors – have been examined, while the hypothesis of two distinct impairments could be retained if errors were to be qualitatively different for the two target types.

In the following section, we will test this possibility by looking at the distribution of error types for affixed and unaffixed targets.

The Error Types to Affixed and Unaffixed Targets

We classified the naming errors according to their *apparent* relation between the response (the first response, as well as the following productions) and the target. In this qualitative analysis, we considered the whole corpus of J.P.C.'s naming errors ($N = 542$): the 317 errors produced as first responses (201 errors for unaffixed items, and 116 for affixed items) and the 225 erroneous responses produced in self-correcting sequences (150 and 75 errors for unaffixed and affixed items respectively). Therefore, the total number of erroneous productions analysed in this section amounts to 351 for unaffixed targets, and 191 for the affixed ones.

As we did not note different tendencies from one examination to another, the results obtained at each examination will not be presented separately here. Likewise, we found it unnecessary to present separately the results obtained for the first erroneous responses and those obtained for the errors noted in self-correcting sequences, because the distribution of errors into the various categories turned out to be quite similar for the two error sets. Thus, the distribution of error types for affixed and unaffixed targets displayed in Table 3 relate to the whole corpus.

As shown in Table 3, the errors produced on affixed items consist not only of morphologically related paraphasias (MRPs). The patient pro-

TABLE 3
Distribution of Error Types for Unaffixed and Affixed Targets

	Unaffixed Targets		*Affixed Targets*	
	N	*(%)*	*N*	*(%)*
Non-responses	20	(5.7)	13	(6.8)
Circumlocutions	79	(22.5)	44	(23.0)
Semantic paraphasias[a]	126	(35.9)	36	(18.8)
Form-related paraphasias[b]	47	(13.4)	18	(9.4)
Morphologically related paraphasias[c]	7	(2.0)	37	(19.4)
Neologisms[d]	26	(7.4)	18	(9.4)
Others[e]	46	(13.1)	25	(13.1)
Total errors	351	(100%)	191	(100%)

[a]Words that are semantically linked to the target, *without having a common morpheme* with it.

[b]All words or nonwords that are phonologically related to the target. These include formal paraphasias (words that share with the target at least 50% of phonemes in the same position), phonological paraphasias (nonword responses consisting of one or more phoneme addition, omission, substitution or permutation in the target word) and partial access to the phonological form of the target.

[c]All word or nonword responses which are analysable in terms of morpheme (affix or stem) addition, substitution or omission in the target word.

[d]All nonwords that cannot be analysed in terms of phoneme omission, addition, substitution or permutation in the target. They comprise either abstruse neologisms (nonwords that are not analysable at all) or morphologically composed neologisms (nonwords that consist of an illegal or unattested combination of two existing morphemes, when none of them is present in the target word).

[e]Error types that were rare in the corpus, like responses that do not have any apparent relation to the target, visual paraphasias and miscellaneous paraphasias.

duced as many MRPs as semantic paraphasias for affixed targets. One wonders, therefore, whether MRPs must, indeed, be *functionally* distinguished from semantic paraphasias.

The functional locus of the deficit leading to these semantic paraphasias is probably not the semantic system itself. Rather, they have to be interpreted as resulting from a strategy used by J.P.C. to cope with his deficit and/or to facilitate the word-finding processes: When faced with a difficulty in retrieving the phonological form of the target, J.P.C. instead produced a semantically related word. As additional arguments in favour of this interpretation, it is worth mentioning that 45% of semantic paraphasias were followed by a spontaneous self-correction and that another 20% were not real semantic errors, because they were preceded by the expression "it is not a . . .". These are clearly instances of a strategy used to facilitate the word-finding process.

When the phonological form of the target is not available, a morphologically related word might be the best candidate for the response, because words that are morphologically related are also very closely related in their meaning. Thus, it might be that the same impaired mechanism is responsible for the occurrence of MRPs and semantic paraphasias. Further, if we add the percentage of semantic paraphasias to the percentage of MRPs, it appears that the errors produced on affixed and unaffixed targets are not distributed in a notably different way. Thus, the morphological structure of words might not play a crucial role in determining the types of errors.

Nevertheless, the existence of semantic paraphasias for affixed words does not, by itself, constitute evidence against the hypothesis of a morphological impairment. We cannot exclude the possibility that J.P.C., failing to retrieve an affixed word through morphological devices, tried to produce a semantically related word by using a whole-word access mechanism.

Finally, only a more fine-grained analysis of the errors, especially the MRPs, can give more insight into the issue. Thus, we will now focus on the morphological error pattern in order to determine whether it is *necessary* to postulate a morphological impairment to account for them or whether they are, indeed, explainable by reference to other properties of the word-retrieval mechanism.

Morphologically Related Paraphasias (MRPs)

From current derivational models, we derived two criteria to distinguish between MRPs that actually result from a morphological impairment and MRPs that must be accounted for by referring to other impaired mechanisms. First, a morphological deficit would impair performance only with regular and infrequent derived words and, secondly, errors should then take the form of affix substitutions and word responses.

TABLE 4
Number (and %) of Erroneous First Responses for Regular and Irregular Affixed Targets of High and Medium/Low Frequency

	High-frequency Targets	*Medium-/Low-frequency Targets*	*Total*
Regular	1/6 (16.7)	52/96 (54.2)	53/102 (52.0)
Irregular	7/27 (25.9)	56/93 (60.2)	63/120 (52.5)
Total errors	8/33 (24.2)	108/189 (57.1)	116/222 (52.3)

The Effect of Regularity and Frequency of the Affixed Target on the Error Pattern. As can be seen in Table 4, regularity has no effect on overall naming performance. As for the frequency effect observed, we must take it as simply reflecting the general feature of the patient's naming difficulties. But consideration of the overall naming performance is not sufficient for our purpose. Irregular and frequent words might be altered following damage to whole-word retrieval processes; on the other hand, regular and infrequent words might be impaired owing to a morphological deficit. In other words, we have to examine the possibility that the deficit leading to naming errors with irregular and frequent words is distinct from the deficit impairing regular and infrequent words. This critical piece of evidence can therefore only be found from a qualitative analysis focusing on the distribution of error types for the two affixed word categories.

Table 5 presents the distribution of error types as a function of the frequency and the regularity of the affixed target (note that the whole corpus of errors is considered here, i.e. first erroneous responses as well as erroneous productions noted in self-correcting sequences). Unfortunately, it is not possible to compare the errors produced on high-frequency items *vs* medium- and low-frequency items qualitatively. There are indeed very few high-frequency affixed items in the battery and, furthermore, errors on this category are also very few. Anyway, the two MRPs produced for high-frequency targets occurred on irregularly derived targets. Thus, these two MRPs cannot be described as resulting from a morphological deficit.

For medium- and low-frequency targets, the distribution of errors into the various types does not show a sharp contrast between regular and irregular targets. But semantic paraphasias and MRPs appear in inverse proportions for regular and irregular words. In particular, there are fewer MRPs and more semantic errors, on the whole and proportionally, with irregular than with regular items. This configuration of results may be viewed as consistent with the hypothesis that errors with irregular words would originate from an impairment of the whole-word retrieval mechanism, which would result in semantic errors rather than MRPs.

TABLE 5
Distribution of Error Types According to the Regularity and the Frequency of the Affixed Target

	High-frequency Affixed Targets		*Medium-/Low-frequency Affixed Targets*			
			Regular		*Irregular*	
	Regular (N)	*Irregular (N)*	*N*	*(%)*	*N*	*(%)*
Non-responses	—	—	5	(6)	8	(9)
Circumlocutions	1	1	20	(23)	22	(24)
Semantic paraphasias	—	2	11	(13)	23	(25)
Form-related paraphasias	—	—	9	(10)	9	(10)
MRPs						
Affix addition	—	—	2		—	
Affix omission	—	—	11		2	
Affix substitution	—	1	4		4	
Stem substitution	—	1	5		7	
Total MRPs	—	2	22	(25)	13	(14)
Neologisms	—	4	7	(8)	7	(8)
Others	—	2	13	(15)	10	(11)
Total errors	1	11	87	(100%)	92	(100%)

However, the pattern of errors for regular and irregular items is not entirely consistent. There are also semantic errors on regular items and MRPs on irregular items. If MRPs also occur in items that probably have to be retrieved from a whole-word mechanism, the question arises of whether MRPs produced in regular items are really the result of a distinct impairment (i.e. morphological) or whether they result from the same deficit that is responsible for MRPs in irregular items. In order to answer this question, we must determine whether the MRPs in irregular items differ qualitatively from the MRPs in regular items.

As shown in Table 5, although affix omission seems to be the special feature of the errors produced for regular targets, we cannot conclude that there are clearly different tendencies for irregular and regular targets, as all types of error are noted for both categories of items. The same can be said if we look at the frequency of the response in comparison with the frequency of the target (see Table 6).

If MRPs for regular items result from a morphological impairment and if MRPs on irregular targets result from an independent, whole-word retrieval deficit, then we should observe a different error pattern for the frequency of the response in comparison with the frequency of the target.

TABLE 6
Comparison Between the Frequency of the Response and the Frequency of the Target for Regular and Irregular Targets (of Medium/Low Frequency)

	Regular		*Irregular*	
	N	*(%)*	*N*	*(%)*
Word response has a higher frequency than the target	8	(36)	4	(31)
Word response has a lower (or equal) frequency than the target	4	(18)	3	(23)
Error is a nonword response	10	(45)	6	(46)
Total MRPs	22	(100%)	13	(100%)

More precisely, MRPs on irregular targets could be considered as particular instances of semantic paraphasias – which we have assumed to be a semantically related word produced when the phonological form of the target is not available – if we note a particular tendency to produce words (instead of nonword responses) that have, in addition, a higher frequency than the target. In fact, we do not observe such a pattern at all for irregular targets and, under this criterion again, the errors for regular targets do not contrast with the errors for irregular targets.

In summary, we have MRPs for irregular as well as for regular targets and there is nothing to support the hypothesis that two distinct impaired retrieval mechanisms actually underlie MRPs for the two categories of targets.

The Pattern of Word vs *Nonword Responses in MRPs.* According to Morton and Patterson (1980), a morphological impairment leads to affix substitutions within the derivational paradigm of a base word. First, as we have seen above, the errors in our corpus do not consist of affix substitutions alone. We also have stem substitutions and, in these cases, the response is more often a nonword (8/13) than a word (5/13). Secondly, we noted affix omissions and affix additions. However, these two kinds of error can be treated as affix substitutions within a derivational paradigm of a stem. In affix omissions, J.P.C. chose the zero morpheme instead of the correct affixal morpheme; in affix additions, he chose an affixal morpheme instead of the zero morpheme.

The pattern of word *vs* nonword responses for all MRPs is given in Table 7. In fact, only affix omissions always lead to a word response. Furthermore, all these errors concern medium- and low-frequency targets, and most

TABLE 7
Number of MRPs for all Affixed and Unaffixed Targets, Leading to a Word or to a Nonword Response

	Word Response	*Nonword Response*
Affix omission	13	—
Affix addition	4	5
Affix substitution	3	6
Stem substitution	5	8
Total	25	19

of them are regularly derived items (11/13). Hence, the errors consisting of affix omissions could be explained by an impairment of the derivational component of the lexicon.

To summarise the findings so far, it appears that only one subset of the MRPs (13/44) – the affix omission errors – can be viewed as resulting from morphological impairment. Yet, as all the other MRPs appeared to be due to other impaired processes, the following questions remain to be answered: Are affix omissions *only* explainable in reference to a morphological impairment? Do they present a particular pattern that suggests that they must be distinguished from other MRPs?

In the following section, we will first try to specify the impaired processes underlying MRPs that cannot be accounted for by a morphological deficit. More precisely, we will examine the possibility that MRPs are, indeed, particular instances of semantic paraphasias or particular instances of formal paraphasias, because errors morphologically related to the target are also semantically and phonologically related to the target. We will then consider whether the pattern of affix omissions cannot be described along the same lines. We will present this analysis by reporting every instance of MRPs ($n = 44$) produced by the patient.

Are MRPs Particular Instances of Semantic or Formal Paraphasias?

Stem Substitutions (n = 13). Because only a fragment of the target phonological form is correctly produced, these errors look very much like purely formal errors in which only a part of the phonological form of the target is retrieved. Hence, it might be that we have to treat these paraphasias in the same way as formal paraphasias. But it might also be that these errors reveal that the retrieving of the stem and the affix are processed through two distinct mechanisms, and what would be impaired in these cases would be the stem retrieval mechanisms.

If this hypothesis were correct, then we would note, as is the case for unaffixed words, that the stem produced more often than not has a semantic relation to the target stem. In fact, of the 13 instances of stem substitutions, 6 do not show such a pattern (see responses 1–6 below):

Target	*Response*
1. tabl*ier* (apron)	pan*ier* (basket)
2. balanç*oire* (swing)	hach*oir* (chopper)
3. *para*vent (screen)	*para*pet (parapet)
4. chauss*on* (bootee)	*balich*on*
5. chauss*on* (bootee)	*touch*on*
6. arm*ure* (armour)	*/lɔsm*yR*/

Furthermore, in (1) and (3), the morphological composition of the response does not show either a semantic or a morphophonemic transparency, and it is not clear whether these words would be generally recognised as affixed items. On the other hand, in responses (4) and (6), the fragment that remains when the suffix is stripped is not a real stem. On the whole, we do not see any indication that would clearly distinguish these paraphasias from formally related paraphasias on unaffixed targets where a non-morphemic fragment ending the word[5] is correctly produced with a substitution error in the non-morphemic initial fragment, like (7) and (8):

7. béquille (crutch)	cheville (ankle)
8. tabouret (stool) (/tabuRɛ/)	*/labeRɛ/

The total number of formally related errors as a function of the morphemic nature and the position of the erroneous fragment is given in Table 8. We note 10 formal errors where more than one final phoneme of the target is present in the same position in the erroneous response that do not have any semantic relation to the target. Thus, stem-substitution errors that are not semantically related to the target do not appear more often than non-morphemic initial fragment substitutions that are not semantically related either.

Hence, we have to treat the stem substitutions in the same way as other initial fragment substitutions and postulate that the same impaired

[5]Of course, this claim does not apply to (3), where the stem is the ending fragment of the prefixed word; this error has to be treated in reference to what will be said about affix substitutions (cf. infra).

TABLE 8
Distribution of Errors Formally Related to the Target, According to the Morphemic Structure and the Position of the Fragment Substitution or Omission

	Morphemic Fragment	*Non-morphemic Fragment*
Substitution of the initial fragment with the final fragment correctly produced	12	10
Substitution of the final fragment with the initial fragment correctly produced	10	14
Omission of the final fragment with the initial fragment correctly produced	13	23
Total	35	47

mechanism underlies the two types of substitution. That these stem substitutions sometimes occur for irregular targets (1 and 3) constitutes an additional argument in support of this account.

As for the other instances of stem substitutions (responses 9–14), there is a semantic relation between the stem produced and the target:

9.	tabl*ier* (apron)	*drat*ier*
10.	interrupt*eur* (switch)	allum*eur* (lighter)
11.	cafet*ière* (coffee machine)	*bouill*ère* (twice)
12.	agraf*euse* (stapler)	*tapot*eur*
13.	cheminée (chimney)	fumée (smoke)
14.	*rétro*viseur (rearview mirror)	**rétri*voir

In these cases, the responses reveal that the patient retrieves a fragment of the target – the affix – and produces a stem that shares some semantic traits with the *whole target* and not with the target stem. For example, *interrupteur* can be defined as something that is used "to switch on the light" (= *allumer*); the patient then produces the word *allumeur* by adding the *-eur* suffix to the stem *allum-*, which is by itself not semantically related to the stem *interrupt-*. In doing so, the response is then a unit that is "constructed" by associating two existing morphemes, in a way that is not attested as regards its form or its meaning (except in the case of 13). As the stem produced has a semantic relation with the whole target rather than

with the target stem, we cannot conclude that the patient produces a semantically related stem instead of the right stem because of a stem-finding difficulty.

Consequently, these responses cannot be explained by reference to an impairment of the mechanisms involved in a distinct retrieval of stems. They cannot either be analysable as word blends. Blend errors generally result from the simultaneous activation of two synonymous words, or occasionally of a subordinate and one of its superordinates (see Garrett, 1982). The stem that substitutes in these paraphasias does not appear to be an element of a competing word presenting this kind of meaning relation to the target. Rather, these unattested units are to be interpreted with reference to a creative lexical behaviour. On the basis of the semantic and phonological information that is currently available, the patient makes up a "new" word, that embodied the phonological fragment available. In addition, such an interpretation can account for certain special instances of responses (occurring with unaffixed as well as affixed targets) that we categorised, on the basis of their apparent relation to the target, either as semantic paraphasias (15) or neologisms (16 and 17). In cases like (15), the response was categorised as a semantic paraphasia, for it was a word response sharing some semantic traits with the target. However, the word produced by J.P.C. conventionally refers to another meaning than the one given in this context (as it is also the case with 10). Thus, this response may be viewed as a nonword that is a homonym of an existing word. In fact, we are faced here with the same "word formation process" as the one shown for *interrupteur*: The response *mélangeur* given for *fouet* (whisk) refers to the function of the object that is used "to mix" (*mélanger*), but *mélangeur* (mixer tap, mixer) is conventionally used in other contexts (plumbing, radio, cinema). These instances, amounting to 27 in the corpus, more often occur in a self-correcting sequence, and not as a first response, which suggests that the patient used this strategy to cope with his deficit, i.e. once the whole-word retrieval fails:

15. fouet (whisk)	mélang*eur* (mixer, mixer tap)
16. arbalète (crossbow)	*tire-arc
17. fauc*ille* (sickle)	*un coupe

We must also mention that this creative lexical behaviour of J.P.C. makes use of all types of word formation devices: derivation (as in 15), compounding (16) and grammatical change (17). Further, similar creative lexical productions were also noted in spontaneous speech. In this situation, novel words were likewise produced after either filled or long silent pauses typical of word-searching behaviour. To give an example, the patient, talking about traffic lights, said: "*le feu est devenu rouge, non* . . .

*pas rouge . . . un peu rouge, *rouget, le feu était *rouget*". In this utterance, the target word was *orange* (orange) and the patient produced instead a semantically related word *rouge* (red), then tried to self-correct (*non pas rouge . . . un peu rouge*/not red . . . a "little" red), and finally produced the novel morphological compound **rouget*,[6] by adding the diminutive suffix *-et* to the word he accessed. In this example, the patient produced a novel adjectival form, but we also noted novel verbal compounds, which indicates that his creative behaviour is not confined to the nominal forms that are typically elicited in a naming task.

Affix Substitutions (n = 9). As was shown in Table 7, five of these substitutions result in a nonword response (20–24). As regards the word responses, two of them (18) are not semantically related to the target (note that the target as well as the response is semantically irregular, i.e. non-semantically transparent). Hence, there is no reason to view these errors as particular instances of semantic errors.

18. *é*tabli (bench)	tabl*ier* (apron) (twice)
19. escal*ier* (staircase)	escab*eau* (pair of steps)
20. *rétro*viseur (rearview mirror)	**re*viseur
21. palm*ier* (palm tree)	*palm*iste*
22. sucr*ier* (sugar bowl)	*sucr*ette*
23. bougeo*ir* (candlestick)	*bougeo*n* (twice)
24. boutonn*ière* (buttonhole)	*passage de bouton

Consequently, as for stem substitutions, we suggest that these errors are particular instances of formally related errors, i.e. J.P.C. would retrieve the initial fragment of the target but would not succeed in retrieving its final portion.[7] Faced with his retrieving difficulties, J.P.C. produced either a formally related word (18 and 19), or a nonce-word by derivating (20–23) or compounding (24) with the word fragment he could access. Here again, the general pattern of naming errors supports this hypothesis (see Table 8).

[6]We analysed the response **rouget* as a novel compound, though *rouget* (with the meaning "red mullet") does exist as a word in French. Indeed, this word is strictly used as a nominal form, while the patient clearly produced **rouget* as an adjectival form. Furthermore, the word-retrieval attempts made by the patient in this context indicate that **rouget* probably did not result from a grammatical change applied to the nominal form *rouget*, but rather from a compounding on the base of the adjective *rouge*.

[7]This does not apply to (20), in which it is the final portion of the word that is retrieved. This error has to be treated with reference to the analysis made above for stem substitutions.

There are in the corpus 14 errors consisting of word-final substitutions that are not analysable as morpheme substitutions (as in 25–27):

25.	tabouret (stool) /taburε/	tablier (apron) /tablije/
26.	bouquet (bouquet) /bukε/	bouquin (book) /buk$\tilde{\varepsilon}$/
27.	ananas (pineapple) /anana/	*/anami/

Affix Additions (n = 9). As noted above, an affix addition to a monomorphemic item can be treated as an affix substitution within the derivational paradigm of the stem, such as the "zero morpheme" is exchanged with one of the affixes. However, among the nine instances of this type of error, five of them led to a nonword response. Obviously, these responses cannot be considered to have resulted from a within-paradigm substitution:

28.	for*euse* (drill)	**per*for*eur*(twice)
29.	médaille (medal)	*médaill*ette*
30.	gourde (flask)	*gourd*eau*
31.	gourde (flask)	*gourd*on*

Whereas (28) is analysable as a blend of two semantically related words (*perforer*, *foreuse*), the origin of the others is unclear. We can only note that (29) was a self-correcting attempt made after the production of an affix addition error that corresponds to a word (32). It may be that the patient, after producing such an affix addition and being aware that he was wrong, tried to add another suffix to the stem "at random".

Let us now consider the four word responses in their production context (the MRPs considered here are underlined):

32.	médaille (medal)	médaill*on*, *médaill*ette* (medallion)
33.	fourche (pitchfork)	c'est pas une pelle, ça prend le foin, c'est pas une fourch*ette* (it is not a shovel, it is to pick up hay, it is not a fork)
34.	casque (helmet)	le croisé, c'est pour aller très vite, c'est pas une casqu*ette* (the crusader, it is for going very fast, it is not a cap)
35.	brancard (stretcher)	brancard*ière* (stretcher-bearer)

We can note that (32) is followed by a self-correcting attempt (**médaillette*); we also note an explicit dissatisfaction for (33) and (34). As for (35), the error can be analysed as a blend of two synonymous words, *civière* and *brancard*. This pattern suggests that, while J.P.C. succeeded in retrieving the full semantic traits of the target, he did not achieve retrieval of the corresponding phonological form. He then produced, instead of the unavailable form, a semantically near word (all these responses are very close semantically to the target, as they are semantically transparent derived words), while overtly displaying that he was well aware the response was wrong. Let us remember that semantically related responses preceded by "it is not a . . ." also often occurred for affixed words. In other words, we have no indisputable indication that these morphological paraphasias have to be treated differently from semantic paraphasias.

Affix Omissions (n = 13). As we have seen above, the hypothesis of a morphological impairment seems here to be the more plausible: 11 out of 13 errors concern regularly derived words of medium and low frequency and all the responses are word responses. Furthermore, the suffix most often omitted in these instances is the *-ette* suffix, which is a productive suffix in French. Thus, we have indications in favour of the morphological deficit hypothesis. However, the pattern of these errors also presents features that weaken it.

First, the 13 instances in this category are characterised by always being a self-correcting sequence following the erroneous response. These attempts led to the correct response in seven instances (MRPs considered here are underlined):

36. noise*tte*	<u>noix</u>, noise*tte*
(hazel)	(walnut, hazel)
37. épaule*tte*	<u>épaule</u>, épaule*tte*
(epaulette)	(shoulder, epaulette)
38. trompe*tte*	*/trɔ̃/, <u>trompe</u>, trompe*tte*
(trumpet)	(horn, trumpet)
39. fourche*tte*	<u>fourche</u>, fourche*tte*
(fork)	(pitchfork, fork)
40. camionne*tte*	<u>camion</u>, petit camion, caravane
(van)	(lorry, little lorry, caravan)
41. roule*tte*	<u>roue</u>, roue du paon
(caster)	(wheel, peacock spreading its tail)
42. roule*tte*	<u>roue</u>, pas tout à fait, une petite roue
(caster)	(wheel, not exactly, a little wheel)
43. boutonn*ière*	<u>bouton</u>, le bouton doit passer par . . . ,
(buttonhole)	le *passage de bouton
	(button, the button has to pass into . . .)

44.	arm*ure* (armour)	arme, c'est pour se bagarrer, arme, arm*ure* (arm, it is for fighting, arm, armour)
45.	bouge*oir* (candlestick)	bougie, bouge*oir* (candle, candlestick)
46.	palm*ier* (palm tree)	palme, *palm*iste* (palm leaf)
47.	*chrono*mètre (chronometer)	mètre, *chrono*mètre (meter, chronometer)

The general pattern of these errors is that J.P.C. produced the stem of the target, tried to self-correct his response, and sometimes succeeded in retrieving the derived related phonological form. Thus, these MRPs constitute J.P.C.'s first attempt to sort out his word-finding difficulties. For these attempts, J.P.C. may have searched for a semantically closely related word. As the targets are almost always very regular, it is not surprising that the word produced corresponds to the stem: the more regular the derived word is, the more closely related the stem and the derived word will be in their meaning. A further argument is that, of the 11 erroneous responses for regular items, 8 consist of words of higher frequency than the target word.

Secondly, we have seen above that stem and affix substitutions were probably particular instances of formally related errors, where J.P.C. partially retrieved the phonological form of the target. In fact, the recovering of the stem of derived words can also be viewed as the retrieval of the target's initial fragment: In the whole corpus (see Table 8), there are 23 instances in which J.P.C. produced an initial non-morphemic fragment (more than one phoneme) of the target, without producing the final portion, as in (48) and (49):

48.	mouton (sheep) /mutɔ̃/	*/mu/
49.	médaille (medal) /medaj/	*/med/

Furthermore, as in the cases of affix omissions, these cases of partial access to the target were often followed by a self-correcting attempt (19/23).

An Attempt to Explain MRPs

To summarise the analysis so far, we have looked at the pattern of naming errors produced by J.P.C. in order to establish whether derivational errors could be explained in reference to an impairment of the morphological

component of the lexicon postulated by some models of word production. In fact, numerous features presented by the pattern of errors that emerged argue against the hypothesis of morphological impairment. Although the general level of naming performance was better for unaffixed than for affixed words, we found that at least 34% of the MRPs (15/44) could not be viewed as resulting from a morphological impairment, for they appear for irregular items, which are assumed to be processed through a whole-word retrieval mechanism. As for the other MRPs, they could be accounted for without appealing to morphological principles. Further, we demonstrated that the two subsets of MRPs were analysable in reference to the general pattern of J.P.C.'s errors, which clearly suggests that he could often retrieve either semantic information or partial phonological information or both about the target. The consequences of this are of several kinds:

1. J.P.C. produced many semantically related responses preceded by the expression "it is not a . . ." or followed by a self-correcting attempt. This behaviour suggests that, in these cases, J.P.C. probably retrieved the semantic information about the target but failed to retrieve its phonological specifications; he then produced an "it is not . . ." response, perhaps to facilitate the word-finding process by activating the corresponding semantic field. This behaviour was observed for unaffixed as well as for affixed items. Some MRPs (affix additions) can be considered as particular instances of this kind of semantically related response.
2. J.P.C. often seemed to retrieve partial information about the phonological form of the target. Sometimes, his erroneous responses shared their initial fragment with the target, sometimes their final fragment. It turned out that these fragments were more often non-morphemic fragments. We concluded that stem and affix substitutions that do not have any semantic relation to the target could be viewed as particular instances of formally related paraphasias resulting from a partial access to the phonological form of the target. Affix omissions, while being suggestive of a morphological impairment in some respects, may also be analysable as a result of partial access to the initial fragment of the target word.
3. The patient produced some stem and affix substitution errors that reveal that both semantic and phonological features of the target were available. These errors cannot be described as semantic paraphasias, because they consist of unattested words; nor can they be satisfactorily interpreted as just formal paraphasias. We showed that they were analysable as nonce-forms embodying the phonological fragment available. These novel words were constructed by the patient when retrieval failed not only for affixed but also for unaffixed words. Moreover, they applied different word formation devices (derivation, compounding and grammatical change) and their construction was most often fully transparent in their meaning and

form. Therefore, this creative behaviour seems to involve spared linguistic capacities, i.e. those accounting for the lexical creativity of normal speakers. Even word production models that assume that all derived words are stored as independent whole units in the lexicon (Butterworth, 1983; Miceli & Caramazza, 1988) still capture speakers' ability to construct novel derived forms: words can be made up by applying rules analogous to those proposed by Chomsky and Halle (1968) or Aronoff (1976), or by analogical word-formation processes (Butterworth, 1983). MacKay's (1978) model also allows the possibility that productive rules, totally independent of lexically stored items, could be directly retrieved in order to create new words. J.P.C. would then use such spared devices as "fall-back procedures" (Butterworth, 1983) when retrieval from the full list fails (see Semenza, Butterwroth, Panzeri & Ferreri, 1990, for a similar neuropsychological report). We now need to gather further experimental data to determine empirically whether or not the creative device used by the patient proceeds from already learned formation rules or from analogical construction processes.

We have concluded that the semantic paraphasias are a result of the efforts J.P.C. made to cope with his deficit, but we have yet to give a functional interpretation to the numerous formally related errors in the corpus. In fact, the formal errors we have analysed so far were not the only instances in which the patient retrieved a part of the phonological information of the target. As our purpose was to compare morphemic fragments (which are often more than one phoneme in length) to non-morphemic fragments, only fragments of more than one phoneme have been considered. However, there are many errors in which the response produced shares with the target the initial or the final phoneme in the same position.

In order to place this partial access phenomena in the context of all the errors,[8] we conducted an error analysis on the basis of a more general error categorisation. In this categorisation, we have disregarded whether the response was a word or not and whether the target was affixed or not. We only distinguished between (1) semantically related errors, (2) formally related errors, (3) semantically *and* formally related errors and (4) others (unrelated, visual and unclassified errors). We also took into account the position of the fragment (one phoneme to more than one syllable) of the target that was present in the same place in the response. We found that 33% of J.P.C.'s responses were semantically related to the target, 26% were formally related and 17% were semantically *and* formally related to the target, i.e. 43% of the erroneous responses shared a partial phono-

[8]Except non-responses and circumlocutions.

logical form with the target. Of them, 61% share a fragment in the initial position, 17% in the final position, 10% in the initial and the final position and, finally, 10% share a fragment in another position with the target. Such a pattern is strongly reminiscent of the data drawn from the studies on the "tip-of-the-tongue" (TOT) state with normal subjects (Brown & McNeill, 1966; Rubin, 1975) and aphasics (Barton, 1971; Goodglass, Kaplan, Weintraub & Ackerman, 1976) and from studies on malapropisms (Fay & Cultler, 1977). These studies indicate that, when retrieving a word, subjects look for certain salient features like word beginnings and endings and numbers of syllables. These word features tend to be recalled even when the full form of the word cannot be retrieved, as is the case in the TOT state or during unsuccessful efforts made by aphasics to name pictures. The saliency of the beginning and the end of words is explained in terms of their relative informativeness in the phonemic system. Furthermore, that the beginning is more often recalled than the end of words is explained by the same principle: In English (and probably in French, too), word beginnings distinguish between words more efficiently than word endings. These data gave rise to a model of word production in which retrieval of a word occurs in two successive stages. In the first stage, partial retrieval leads to what has been termed a "linking address" (Garrett, 1984), a "faint entry" (Brown & McNeill, 1966) or a "word-sketch" (Jones & Langford, 1987), containing the word's most important, salient phonological features such as word initial, word final, number of syllables and stress pattern. In the second stage, these salient features are used to retrieve the word's complete phonological form. If there is an abnormality in the process so that the partial retrieval does not yield the correct phonological form of the word, a subject can still base his output on the partial information he accessed at the first step. Therefore, the word produced will have some phonological features in common with the intended word (Garrett, 1984).

Therefore, the numerous formally related errors of J.P.C. suggest that, at least for 43% of his errors, his word-finding difficulties occurred at the second stage of word production, the "linking address" remaining spared. A similar phenomenon has been reported in studies with aphasic subjects. Barton (1971, p. 81) showed that the "un-named target word is present in some 'schematic' form somewhere in the linguistic system" for many of his aphasic subjects. The results of Goodglass et al. (1976) indicate that conduction aphasics could identify both the first letter and the syllabic length of the words they could not name. However, in these studies, aphasics displayed their partial knowledge about the target word they failed to name in a task when they were *explicitly* asked if they had an idea of the correct word and knew what it sounded like (Brown & McNeill's, 1966, procedure), which was not the case in the naming task we presented

to J.P.C. Thus, it seems that a particular feature of J.P.C.'s word-searching behaviour is that he made "active" use of the partial information he retrieved.

CONCLUSION

We have reported the case of a patient whose striking and original characteristic was to produce many apparent morphological errors in naming pictures. The analysis we conducted on the errors pattern of this patient revealed that only a minority of them, i.e. the affix omissions, could be the result of a morphological impairment, although these errors also turned out to be explainable in terms of another word-retrieval mechanism. These results do not advance the theoretical issue of how derived words are processed during production. But it seemed to us that it was worth presenting the original pattern of J.P.C.'s word-finding difficulties and trying to find a rationale that could account for them, whatever their origin turned out to be. Moreover, our attempt to account for J.P.C.'s errors gave us the opportunity to develop a methodological framework, based on theoretical constraints, within which any corpus analysis of apparent morphological errors produced in picture naming could take place if decompositional models are under consideration.

Manuscript received April 1989
Revised manuscript received December 1990

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