

**Agrammatism in Sentence Production without
Comprehension Deficits: Reduced Availability of Syntactic
Structures and/or of Grammatical Morphemes?
A Case Study**

JEAN-LUC NESPOULOUS,*† MONIQUE DORDAIN,‡ CÉCILE PERRON,*†
BERNADETTE SKA,† DANIEL BUB,†§ DAVID CAPLAN,†§ JACQUES MEHLER,||
AND ANDRÉ ROCH LECOURE,†¶

**Département de Linguistique et Philologie, Université de Montréal, Canada;
†Laboratoire Théophile Alajouanine, Centre Hospitalier Côte-des-Neiges, Montréal,
Canada; ‡INSERM, Hôpital Fontmaure, Clermont-Ferrand, France; §Montreal
Neurological Institute, Montreal, Canada; ||Centre d'étude des processus cognitifs
et du langage, Laboratoire de Psychologie EHESS-CNRS, Paris, France; and
¶Faculté de Médecine, Université de Montréal*

A French-speaking patient with Broca's aphasia—following a left-hemisphere lesion involving the sylvian region but sparing Broca's area—is presented. Like G. Miceli, A. Mazzuchi, L. Menn, and H. Goodglass's (1983, *Brain and Language*, 19, 65–97) case 2, this patient produces agrammatic speech in the absence of any comprehension deficit. Unlike Miceli's patient, though, agrammatic speech can be observed in all sentence production tasks (from spontaneous speech to repetition, oral reading, and writing) whereas production of individual words—be they open class or closed class—is almost always intact. On the basis of extensive (psycho)linguistic testing, it is argued that this patient's deficit is not central and not crucially syntactic (at least) at the level of knowledge but seems to disrupt specifically those (automatic?) processes responsible for both retrieval and production of free-standing grammatical morphemes whenever they have to be inserted into phrases and sentences. © 1988 Academic Press, Inc.

Contents. 1. Introduction. 2. Mr. Clermont: Case history. 3. CT scan. 4. Linguistic performances: Oral production. 4.1. Narrative speech. 4.1.1. Omission of obligatory items. 4.1.2. Substitution of Obligatory Items. 4.1.3. Reduced Production of Non-Obligatory

We thank Elisabeth Bates, Alfonso Caramazza, Yves Joanette, Merrill Garrett, Harold Goodglass, Gonia Jarema, Herman Kolk, Gabriele Miceli, Lise Menn, Loraine Obler, Stephanie Shattuck-Hufnagel, and all our students in Montréal for their comments on an earlier version of this paper. Address correspondence and reprint requests to Jean-Luc Nespoulous, Laboratoire Théophile Alajouanine, Centre Hospitalier Côte-des-Neiges, 4565 Chemin de la Reine Marie, Montréal, P.Q., H3W 1W5, Canada.

Items. 4.1.4. Spared Morpho-Syntactic Items. 4.2. Naming. 4.3. Repetition and oral reading. 4.3.1. Single words. 4.3.2. Sentences. 4.3.3. Oral reading of text. 4.3.4. "Vertical reading." 4.3.5. Oral reading of sentences with several personal pronouns. 4.3.6. Oral reading of sentences with homonyms. 4.3.7. Repetition of lists of open-class words. versus repetition of sentences. 4.4. Story completion test. 5. Linguistic performances: Oral comprehension. 6. Linguistic performances: Written production and other tests-implicating-written-material. 6.1. Written narrative discourse. 6.2. Dictation. 6.3. Sentence completion test. 6.4. Metalinguistic tasks. 6.5. Sentence anagram tasks. 7. Conclusion. 7.1. Localization of lesions. 7.2. Mr. Clermont's agrammatism.

1. INTRODUCTION

In many older aphasiological writings, "agrammatism" refers to a production deficit typically observable in some (and clearly not all) patients with Broca's aphasia, usually after a period of evolution (Alajouanine, 1968).¹ More recently, though, Zurif, Caramazza, and Myerson (1972), Caramazza and Zurif (1976), and Berndt and Caramazza (1980) have brought to light the existence of agrammatic patients with a comprehension deficit closely parallel to the one they show in sentence production, thus making it plausible for such patients to suffer from a central grammatical deficit independent of the linguistic tasks they perform (production versus comprehension).²

Miceli, Mazzuchi, Menn, and Goodglass (1983) demonstrated that, while present in some agrammatic patients, such a comprehension deficit was not constantly observed in all agrammatic subjects and that "pure agrammatism of speech" thus existed.

This paper presents the case of a French-speaking agrammatic patient who, like Miceli et al.'s cases, does not show any comprehension deficit, but who, unlike the latter, produces "classical" agrammatic output in all oral and written sentence production tasks whereas the production of individual words—be they open class or closed class—is intact. Although our patient's linguistic performances may very well turn out to be "exceptional" within the context of the symptomatology of Broca's aphasics in general and of agrammatic patients in particular, they raise very important questions in relation to the most recent accounts of agrammatism to be found in the aphasiological literature:

- Is agrammatism a central or a selective deficit (production versus comprehension)?
- Is agrammatism a syntactic deficit, a phonological deficit (Kean, 1979),

¹ An earlier version of this paper was presented at the Annual Meeting of the Academy of Aphasia, Los Angeles, October 28–30, 1984.

² It is nevertheless to be noted that, as early as the beginning of the century, several aphasiologists had already mentioned the existence, in some Broca's aphasics, of "parallel" deficits in sentence production and comprehension: Bernheim (1900), Bonhoeffer (1902), Goldstein (1913), Salomon (1914), and Kleist (1916).

or is it a specific processing deficit affecting the availability of "closed class" items?

- How are we to interpret the dissociations often observed across tasks and subtasks in the verbal performances of a single patient?
- How are we to differentiate (if possible), in the patient's verbal behavior, the "direct" effects of the underlying deficit, whatever it may be, from its "indirect" effects originating from the potential coming into play of adaptive strategies?
- What is to be done with the agrammatism versus paragrammatism dichotomy?
- What is to be said about anatomo-clinical correlations when lesion site does not abide by what might be expected on the basis of the symptomatological observation?

2. MR. CLERMONT: CASE HISTORY

Mr. Clermont,³ a unilingual⁴ insurance executive with a college education, was 54 years of age when hospitalized in November, 1978 for a right hemiplegia and a verbal suppression following a stroke. He was right-handed without a family history of left-handedness. It should be noted that, about 1 year before, Mr. Clermont had suffered from a first transient ischemic attack, with right hemiparesis and verbal suppression, which lasted only a few minutes, all medical and linguistic examinations, carried out the following day, being normal.

On admission to Fontmaure Hospital, in 1978, the patient was conscious. His routine neurological examination showed a right hemiparesis, mainly affecting the right upper limb, and a right Babinski's sign. DTRs were normal. No unilateral primary sensory disorders were noted. Fundi were normal and the visual fields were full. The brain scan showed ill-defined heterogeneous increased uptake in the left temporal region. Cardiac examination revealed auricular fibrillation. It was thus concluded that Mr. Clermont had suffered from a left sylvian infarct of embolic origin and he was then treated for his dysrhythmia.

From the linguistic point of view, Mr. Clermont, during the first week postonset, showed a verbal suppression in the absence of any comprehension deficits for both auditory and visual stimuli. At this early stage, writing was completely impossible. On leaving the hospital, a fortnight postonset, Mr. Clermont's oral production was limited to a stereotype

³ A pseudonym given to our patient on account of his geographical origins (Clermont-Ferrand, France). We express our most heartfelt thanks to Mr. Clermont; without his exceptional cooperation, the in "depth analysis" of his agrammatism would have been impossible and many crucial details would be ipso facto missing in this paper.

⁴ Mr. Clermont did know some English and German but he was never considered to be a fluent speaker in either language.

(/ke/ . . . /ke/ . . . /ke/) and to a few verbal automatisms ("How are you?" . . .); as for his written production, it was limited to a few words, written with his left hand.

Followed up by one of us (M.D.), Mr. Clermont, a few months after his cerebrovascular accident, appeared clinically as a clearcut Broca's aphasic with (a) reduction of verbal output, (b) massive arthric disorders, and (c) agrammatism, as illustrated by the following sample of conversational speech, recorded 6 months postonset.⁵

D: "Qu'est-ce qu'il vous est arrivé?"

C: "Brusquement . . . paralys/e/ parole . . . perte de parole . . . clinique . . . docteur . . . Fontmaure."

D: "Est-ce que vous fumez toujours autant?"

C: "Non. Baiss/e/ . . . 12 jours environ."

D: "En sortant, ou êtes-vous allé?"

C: "Hôpital Montluçon . . . deux jours . . . huit jours sans marcher."

In parallel, the absence of auditory and visual comprehension deficits was again noted, together with the absence of open-class word-finding difficulties in all tasks.

3. CT SCAN

Five years postonset, CT scan shows an area of hypodensity on cuts 4 to 8. The hypodensity involves the posterior half of the insula and probably the posterior part of the putamen; it involves also the posterior half of the first temporal gyrus including Heschl gyrus and planum temporale posterior to it. On higher cuts, the hypodensity extends to the inferior part of the precentral and postcentral gyri and to the supramarginal gyrus.⁶ (See Fig. 1.)

In 1982, Mr. Clermont was integrated, as a prototypical agrammatic patient, to the CLAS-Project (Cross-Language Aphasia Study, Menn & Obler, in press). There began for him a series of detailed investigations, some of which within the CLAS-Project, many others being added up on account of the importance of the questions raised by his symptomatology. It is the entirety of these investigations that we discuss in the present paper.

⁵ (D, examiner; C, patient. Whenever verbal inflections were ambiguous—as in "paralys/e/" and "baiss/e/" in this sample—where it is impossible to determine whether the patient produced an infinitive ("paralyser"; "baissier") or a past participle ("paralysé"; "baissé"), we have transcribed such bound morphemes using the International Phonetic Alphabet.

⁶ Ct-scan interpretation was originally done, in Fontmaure's Hospital, by Anne-Marie Georget, neuroradiologist, and was later revised by Marie Vanier, "fellow" of the Medical Research Council of Canada (Montreal Neurological Institute, McGill University).

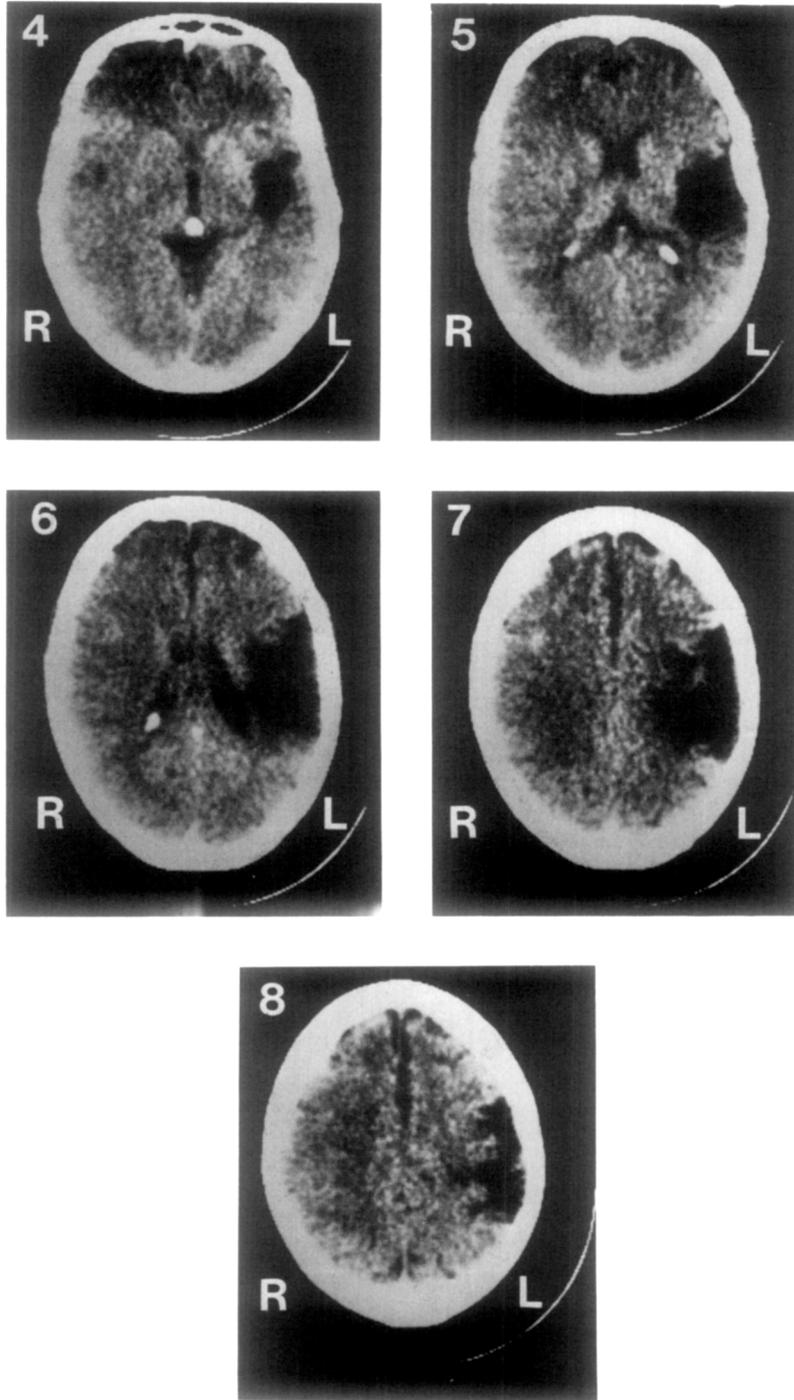


FIGURE 1.
277

TABLE 1
MORPHEME ERRORS AND DISTRIBUTION: NARRATIVE SPEECH

	Expected morphemes		Correctly supplied		Substitutions		Omissions	
	<i>N</i>		<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Articles	156		113	72	23	15	20	13
Other det.	33		27	82	2	6	4	12
Adjectives	23		18	78	4	17	1	5
Pro.	59		49	83	1	2	9	15
Cli.	36		12	33	5	14	19	53
Auxiliaries	20		10	50	1	5	9	45
Have-be verbs	14		7	50	0	0	7	50
Verbs	131		120	92	4	3	7	5
Relative pron.	2		2	100	0	0	0	0
Subord. conj.	3		0	0	0	0	3	100
Coord. conj.	27		26	96	1	4	0	0
Lexical prep.	55		44	80	5	9	6	11
Nonlexical prep.	45		28	62	2	4	15	34

Note. "Pro" stands for "subject pronouns" and "Cli" for "preverbal object and reflexive pronouns" (cf. Nespoulos et al., in press).

4. LINGUISTIC PERFORMANCE: ORAL PRODUCTION

4.1. Narrative Speech

Taken from the CLAS-Project, the following narrative tasks were proposed to Mr. Clermont:

- The history of illness;
- "Little Red Riding Hood";
- The "Cookie theft" from the Boston Diagnostic Aphasia Examination (Goodglass & Kaplan, 1976);
- The Wechsler-Bellevue stories.

The four narrative tasks enabled us to gather a corpus of 751 words, containing 130 phrases, with a total utterance time of 17'31" (43 words/minute, 7 phrases/minute) and a mean phrase length (= syntactically well-formed strings) of 6 words.

A detailed account of all quantitative data gathered for the CLAS-Project being presented elsewhere (Nespoulos et al., in press), we only expose here those elements which are directly relevant to the theoretical issues we intend to raise.

Table 1 leads to the following qualitative conclusions:

4.1.1. *Omission of obligatory items.* The order of omission from more to less is

- Object and reflexive clitic pronouns;
- “Have/Be” auxiliaries as well as main verbs;
- Prepositions, particularly the ones that “are idiosyncratically associated with particular verbs” (Kean, 1982), such as “de” in “essayer de” (= “try to”), “à” in “parvenir à” (= “succeed in”) . . . ;
- Articles.

4.1.2. *Substitution of obligatory items.* This is a phenomenon which, in narrative speech, is less frequent than omission. The order of substitution from more to less is

- Articles;
- Object and reflexive clitic pronouns;
- Prepositions, particularly “lexical” prepositions (Friederici, 1982), such as those indicating location.

4.1.3. *Reduced production of nonobligatory items.* Although it is very difficult to clearly set the range of “normal” performance for many of the following parameters (under 4.1.3 and 4.1.4), one observes

in the Noun phrase

- Almost no adjectives;
- Almost no genitives;
- Almost no relative clauses.

in the Verb phrase

- No subordinate clauses attached to the verb;
- No complex verbal tenses;
- “Preferential” production of prepositional phrases and of infinitive clauses—of the /“pour” + INF/type—as verbal expansions: e.g., “pour conduire” (= to drive), “pour apporter le beurre” (= to carry the butter) . . .

4.1.4. *Spared morpho-syntactic items.*

- Syntactic structures are adequately organized around nouns and verbs;
- No morphological errors on verbal inflections;
- Word order is preserved.

Within the context of the CLAS-Project—based almost exclusively on narrative discourse production—Mr. Clermont’s symptomatology was then temporarily interpreted as follows: (a) the basic underlying deficit leading to the production of agrammatic speech is syntactic; (b) such a deficit disrupts the construction of complex syntactic frames, which, in

Garrett's terms, include grammatical morphemes (Garrett, 1980); (c) the deficit may be counterbalanced and compensated for—in some cases—by the existence of alternative encoding routes, “lexical” vs. “syntactic” (Caramazza & Zurif 1976), which might account for the fact that Mr. Clermont tends to produce fewer errors, mainly substitutions, on “lexical prepositions”—which can presumably be accessed through a “lexical route”—whereas he makes more errors, mainly omissions, on “nonlexical prepositions” which can only be accessed through a specific route devoted to closed-class items (Bradley, 1983).

4.2. Naming

As already mentioned, Mr. Clermont's verbal behavior is rather striking as far as open-class lexical production is concerned. Indeed, not only is the patient able to retrieve and produce without hesitation *all* “expected” words in picture naming—including 26 nouns and verbs from the Montréal–Toulouse Aphasia Battery (Nespoulous et al., 1986) *and* 25 items from the “Examen du Langage” (Ducarne, 1965), but he goes as far as giving sometimes several synonyms in relation with a given stimulus.

Example:

Stimulus: A fortress (of those built up by the
Germans along the Normandy coast
during World War II).

Mr. Clermont: A fortress.
A castle.
A bunker.
A bastion.

The only deficit that can be observed in naming tasks, as well as in any other oral production task, is his phonetic and/or phonemic disorder. In relation with Miceli et al.'s patients (1983), it must be mentioned that they were (also) described as having naming abilities “within the normal range.”

4.3. Repetition and Oral Reading

4.3.1. Single words. Mr. Clermont was given the standard tasks from Ducarne's Aphasia Battery (1965), together with Beauvois and Derouesne's (1981) and Segui et al.'s (1982) word lists, the two latter lists including both open-class and closed-class lexical items and controlling as strictly as possible word frequency, word length, and phonemic structure. Except for the presence of phonetic and phonemic deviations, his production of target-words (= 391 open-class and 286 closed-class items) is accurate in both repetition and oral reading.

As far as reaction times are concerned, Mr. Clermont's performances, in both repetition and oral reading of Segui et al.'s stimuli, are within the normal range (in the oral reading test, Mr. Clermont was so rapid that the clinician hardly had enough time to turn over the pages of the protocol).

Nevertheless, in repetition, when attempting now and again to produce an article (absent from the target) together with target nouns, he often gives an erroneous one (e.g., "un" for "une"; "une" for "un"; "le" for "la"), and this observation led us to devise an additional test.

Articles, together with object and reflexive clitic pronouns (i.e., grammatical morphemes that Mr. Clermont is having difficulty with in connected discourse, cf. *supra*), being absent from the above-mentioned lists—for obvious reasons: the authors of these lists had to find out both open-class and closed-class items of *equivalent* frequency—we tried to test those items ($N = 30$) within the context of a specific reading task. Mr. Clermont did produce some errors ($N = 4$, i.e., in 13.3% of the cases), often followed by self-corrections, in that task, thus indicating that such items, despite their high frequency, might be occasionally difficult for him to process, even when presented "in isolation." Despite the fact that so few errors were gathered in such a task, there does not appear to be a preferential tendency in Mr. Clermont's substitutions.

4.3.2. *Sentences*. Contrasting with the above is Mr. Clermont's performance in both sentence repetition and oral reading. Indeed, in both tasks⁷—made of 50 sentences in repetition and of 66 sentences (the same + 16) in oral reading, and including all types of frequent syntactic structures with all types of grammatical morphemes being equally present—grammatical morphemes are frequently misselected or omitted—the former tendency being often more frequent than the latter, contrary to what has been generally observed in oral narrative speech.

When having a close look at Tables 2 (repetition) and 3 (oral reading), one can observe

- that, on average, errors in sentence repetition are more frequent than errors in oral reading of the same sentences;
- that, there are fewer omissions in oral reading than in repetition;
- that, in oral reading, there are more substitutions than omissions, which does not appear to be the case in repetition.

Errors only involve free-standing grammatical morphemes; all categories (prepositions, articles, pronouns. . .) are affected and substitutions are always "within category" without any clearcut preferential tendency. As far as personal pronouns are concerned, though, one notes that Mr.

⁷ i.e., even in oral reading in which the written stimuli remain in front of him as long as needed.

TABLE 2
MORPHEME ERRORS AND DISTRIBUTION: SENTENCE REPETITION

	Expected morphemes	Correctly supplied		Substitutions		Omissions	
	<i>N</i>	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Articles	82	63	78	9	10	10	12
Pro.	16	11	69	4	25	1	6
Cli.	11	7	64	1	9	3	27
Lexical prep.	39	30	68	3	7	6	15
Nonlexical prep.	15	6	41	5	33	4	26

Note. Only those morphemic categories in which enough quantitative data were gathered were kept for analysis.

Clermont tends to substitute subject pronouns ("Pro" pronouns in Tables 2 and 3) whereas he tends to omit preverbal object and reflexive pronouns ("Cli" pronouns in Tables 2 and 3), suggesting that the structural status and complexity of some grammatical morphemes may play a role in determining, at least in part, the type of errors the patient generates.

Perfectly aware of his errors, Mr. Clermont frequently attempts self-correction but he only succeeds in these attempts in about 50% of the cases.

4.3.3. *Oral reading of text.* Within the context of the CLAS-Project, Mr. Clermont was asked to read aloud a short version of "Little Red Riding Hood" (Nespoulous et al., in press) (see Table 4).

His production in this task is massively disturbed. Indeed, in most cases—apart from prepositions of both types—Mr. Clermont makes more errors than in sentence reading! With the exception of nine derivational and inflectional errors on main verbs—e.g., "porter" → "emporter"; "obtint" (preterite) → "obtient" (present); "ai apporté" (present perfect) → "apporterai" (future)—errors involve (again) substitutions

TABLE 3
MORPHEME ERRORS AND DISTRIBUTION: SENTENCE READING

	Expected morphemes	Correctly supplied		Substitutions		Omissions	
	<i>N</i>	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Articles	105	82	79	18	17	5	4
Pro.	24	18	76	5	20	1	4
Cli.	15	11	74	2	13	2	13
Lexical prep.	48	43	92	4	6	1	2
Nonlexical prep.	38	29	78	3	7	6	15

TABLE 4
MORPHEME ERRORS AND DISTRIBUTION: ORAL READING OF TEXT
("LITTLE RED RIDING HOOD")

	Expected morphemes		Correctly supplied		Substitutions		Omissions	
	<i>N</i>		<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Articles	55		37	69	12	21	6	10
Pro.	24		15	63	6	25	3	12
Cli.	25		12	48	4	16	9	36
Lexical prep.	17		17	100	0	0	0	0
Nonlexical prep.	22		17	78	1	4	4	18

and omissions of free-standing grammatical morphemes, particularly articles, object clitic pronouns, conjunctions and prepositions, . . . (again) the very same categories as those disturbed in oral connected speech (Cf. supra) and again without any clearcut preferential trend in morphemic substitutions. Nevertheless, the tendency to substitute "Pro" pronouns and to omit "Cli" pronouns is again noted.

4.3.4. "Vertical reading." Mr. Clermont was given a "vertical" reading test in order to further assess the above-mentioned and systematic dissociation between (a) the adequate production of (almost) all closed-class lexical items when presented in isolation and (b) their frequent erroneous production when inserted into sentences. Mr. Clermont's performance was expected to be much better in "vertical" than in "horizontal" standard sentence reading test, the former test allowing him to reply more systematically on a word by word (intact! cf. supra) reading strategy. The sentences (20 altogether) used for this task were the same as those devised for the testing of comprehension of sentences with center-embedded relative clauses (cf. infra) (see Table 5).

As expected, the patient starts the oral reading of sentences without

TABLE 5
MORPHEME ERRORS AND DISTRIBUTION: VERTICAL READING

	Expected morphemes		Correctly supplied		Substitutions		Omissions	
	<i>N</i>		<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Articles	40		33	82	6	15	1	3
Auxiliaries	10		9	90	0	0	1	10
Have-be verbs	4		2	50	1	25	1	25
Relative pron.	20		11	55	9	45	0	0
Lexical prep.	3		3	100	0	0	0	0

TABLE 6
MORPHEME ERRORS AND DISTRIBUTION: ORAL READING OF SENTENCES WITH HOMONYMS

	Expected morphemes	Correctly supplied		Substitutions		Omissions	
	<i>N</i>	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Articles	20	16	80	3	15	1	5
Pro.	12	11	92	1	8	0	0
Cli.	4	4	100	0	0	0	0
Lexical prep.	13	13	100	0	0	0	0
Nonlexical prep.	3	2	67	0	0	1	33

any difficulty. He reads aloud the first word (most of the time an article), then the second one (usually a noun) without error; but, when he gets to the third or fourth word—suddenly “realizing” it is a sentence he is uttering (“Oh! C’est une phrase!”; “Oh! It’s sentence!”), he says—he starts producing errors of the above-described type: again, mainly substitutions, often involving the relative pronouns (with 45% of errors: “qui” → “que”; “que” → “qui”).

4.3.5. *Oral reading of sentences with several personal pronouns.* Twenty sentences with several pronouns were devised (e.g., “Il faudra bien que tu le lui dises un jour.”) in order to further document Mr. Clermont’s difficulty in processing such grammatical morphemes. His performance on such a task is disastrous, not a single sentence being correctly read with all its grammatical constituents. In fact, there are so many errors—and so many successive approximations to the target-words—that it is impossible to analyze them in detail in terms of omissions, substitutions, and self-corrections. Yet, as in oral narrative discourse, most errors involve preverbal object and reflexive pronouns and relatively spare subject pronouns.

4.3.6. *Oral reading of sentences with homonyms.* In a last reading task, Mr. Clermont was asked to read aloud 20 sentences in which two words (one open-class and one closed-class item) were homonyms (e.g., “sous” which, in French, can be either the preposition for “under” or the noun for “money”: “Les sous du boucher sont cachés sous le lit” (The butcher’s money is hidden under the bed. See Table 6).

Even though the number of errors in such a task is rather small (!), Mr. Clermont, again, shows evidence of some difficulties—mainly substitutions of articles and omissions of nonlexical prepositions—in processing grammatical morphemes. He, nevertheless, produces *all* open-class lexical items correctly, even those which have the same phonemic structure as grammatical morphemes, which suggests that his parsing abilities are

TABLE 7
MORPHEME ERRORS AND DISTRIBUTION: SENTENCE REPETITION

	Expected morphemes	Correctly supplied		Substitutions		Omissions	
	<i>N</i>	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Articles	86	75	87	7	8	4	5
Pro.	16	14	88	1	6	1	6
Cli.	9	2	22	0	0	7	78
Lexical prep.	25	16	64	8	32	1	4
Genitive markers ("de")	10	10	100	0	0	0	0
Other nonlexical prep.	7	2	29	1	14	4	57

intact (cf. *infra*. 4.3.7.) and that his problem clearly involves the specific processing of grammatical morphemes.

4.3.7. *Repetition of lists of open-class words versus repetition of sentences.* In order to assess his capacity to parse correctly the sentences he was given—in other words, in order to determine whether Mr. Clermont's erroneous production depended upon a deficient integration of the sentences he was presented with—Mr. Clermont was asked to repeat 36 sequences of five open-class words presented to him as a random list of "semantically unrelated" words (Condition A: "parcs"; "animaux"; "arbres"; "fleurs"; "résistant") versus (2 days later) integrated within a sentence (Condition B: "Dans les parcs à animaux, les arbres à fleurs résistant").

Interestingly enough, when presented with random lists of words (Condition A), Mr. Clermont can only repeat three of them (on average), whereas, when presented with the same five words within a sentence (Condition B), he repeats them all despite omission of "Cli" pronouns and nonlexical" prepositions and substitution of "lexical" prepositions (see Table 7). Amazingly enough, Mr. Clermont performs rather well, in that task, on articles and genitive markers, thus indicating that a certain amount of "intertask" variability does exist in his way of handling grammatical morphemes. When comparing, now, the errors generated in such a task with those observed in our former sentence repetition test (cf. Table 2), "intratask" variability then appears, thus indicating that Mr. Clermont's difficulty in handling adequately grammatical morphemes is certainly not an all-or-none phenomenon (Kolk & Van Grunsven, 1985).

Finally, the fact that Mr. Clermont is better at producing open-class words when they are inserted into sentences than when they are presented as random lists is certainly consistent with his deficit not affecting sentence parsing (cf. *infra*), the latter helping him, so it seems, to "memorize" better the different open-class words present in the sentence. On the

basis of such evidence, Mr. Clermont's deficit thus appears to be clearly one of production rather than one of integration.

4.4. *Story Completion Test*

Presented with the different "stories" (52 altogether, testing 16 different morpho-syntactic structural properties) of the French version (Lavallée-Huynh, 1975) of Goodglass et al.'s test (Goodglass, Berko-Gleason, Bernholz, & Hyde, 1972), Mr. Clermont behaves as in all other sentence production tasks: he substitutes or omits free-standing grammatical morphemes. Despite the fact that more data would be required in order to sort out such an issue, Mr. Clermont's errors in that task do not seem to be dependent on the intrinsic complexity of the sentences he has to produce. One does get the impression that, whenever he has to produce a grammatical morpheme (whatever it may be, apart from verbal inflections), he is having difficulties; thus, the more numerous closed-class items are within the context of a given sentence (or "text", see 4.3.3.) he has to produce, the more errors he is likely to make, even if the sentence is syntactically of moderate complexity (cf. Kolk, Van Grunsven, & Keyser, 1985; Nespoulous & Dordain, in preparation). As noted earlier, Mr. Clermont makes errors (substitutions) even in single-word repetition, when he decides to add up articles, thus building up what can be considered as the least complex noun phrases in a language such as French!

The only qualitatively clearcut and quantitatively reliable result of the Story Completion Test seems to give some credit to the above-mentioned impression. Indeed, in 90% of the cases, Mr. Clermont tends to borrow nouns from the initial sentences produced by the examiner. Even if, indeed, normal speaking subjects may occasionally (in 25% of the cases, on average, in our standard normative data in French) use nouns rather than resort to subject or object anaphorical pronouns in such a task, never has such a strategy been preferentially used by any of Lavallée-Huynh's 18 normal controls (Lavallée-Huynh, 1975).

Stimulus: "Marie voudrait sortir" (Mary would like to go out). "Alors, elle ouvre la porte et qu'est-ce qu'elle fait?" (So, she opens the door and what does she do?).

Mr. Clermont's response: "Marie sort" (Mary goes out).

Now, if, in the case of sentences with *preverbal* object pronouns in French (e.g., "Pierre le voit" = Peter sees him), one could argue that structural syntactic complexity is greater than in semantically equivalent sentences without such pronominal elements ("Pierre voit Paul" = Peter sees Paul), in which one finds the canonical SVO order of constituents, such an argument does not appear to stand when one comes to consider sentences with and without subject pronouns. Indeed, in the latter case, the structural syntactic complexity appears to be exactly the same in

both sentence types: e.g., "Pierre voit Paul"/"Il voit Paul". We thus submit that, if Mr. Clermont definitely prefers to compute a noun rather than a subject pronoun in such a task, it is not basically for "syntactic" reasons but because of a lack of availability of grammatical morphemes. Even if, as we know (see Tables 1-7), our patient has fewer problems with subject pronouns ("Pro" pronouns) than with object and reflexive pronouns ("Cli" pronouns), he nevertheless produces a noun instead of a subject pronoun in two-thirds of the cases!

In Summary, the analysis of Mr. Clermont's oral production—in both narrative discourse and "formal" tasks—indicates

- that Mr. Clermont does not evidence difficulties in the isolate processing of grammatical free-standing morphemes, with the only (partial and occasional) exception of articles and clitic pronouns (cf. supra);
- that he often begins making errors whenever such grammatical morphemes are inserted into phrases and sentences, be it within the context of narrative discourse—in which omissions are more frequent than substitutions—or within the context of any other sentence production task—in which substitutions are sometimes more frequent than omissions;
- that even though no preferential qualitative pattern can be evidenced in his substitutions—which are systematically "within category"—some grammatical morphemes tend to be preferentially omitted while others tend to be preferentially substituted;
- that there is a certain amount of variability in his performances, both "intertask" and "intratask" (Kolk & Van Grunsven, 1985; Kolk, in press);
- that, even though the syntactic complexity of Mr. Clermont's sentences, in narrative discourse, is reduced (Table 1), it is not yet possible to say whether such a reduction is a direct consequence of a syntactic deficit or the surface manifestation of an adaptive strategy.

Thus, as suggested in the title of our paper, the problem remains to determine whether Mr. Clermont suffers from a specific reduction in availability of closed-class lexical items only manifest when the latter have to be inserted into syntactic frames and/or whether he has difficulty in generating those syntactic frames themselves, particularly the most complex ones; but other data are needed for that matter before we attempt to conclude, among which, first and foremost, are Mr. Clermont's performances in comprehension tasks.

5. LINGUISTIC PERFORMANCES: ORAL COMPREHENSION

As mentioned earlier, Mr. Clermont's comprehension, from the outset, appeared to be quite "normal" to his clinicians. First assessed with

Ducarne's Aphasia Battery (1965) and De Renzi and Vignolo's Token Test (1962), his performance on comprehension tasks was again tested, 5 years postonset, with (a) the 38 sentences from the Montréal-Toulouse Aphasia Battery-Beta (Nespoulous et al., 1986), (b) 20 sentences assessing his understanding of passive sentences, (c) 20 sentences with center-embedded relative clauses (Caramazza & Zurif, 1976), (d) the sentences specifically devised by one of us (D.C.) to assess syntactic comprehension (Caplan, in press), (e) the "comprehension check" from the CLAS-Project (i.e., nine commands requiring manipulation of objects), (f) 38 commands including the specific decoding of articles and pronouns, and (g) 120 sentences (Hannequin et al., 1986) devised to assess aphasic patients' ability to decode syntactic structures with homonymous nouns and verbs ("Il règle la montre" vs. "il montre la règle").

In all these tasks, Mr. Clermont does not make a single error. Indeed, he thus performs better than some control subjects on the most complex (task "d," in particular). Together with other above-mentioned tasks (cf. 4.3.6. and 4.3.7.), these results thus indicate that Mr. Clermont's ability to parse adequately the sentences he is presented with is utterly normal and that his basic underlying deficit is one of production rather than one of comprehension.

Nevertheless, Mr. Clermont having not yet been proposed "on-line sentence comprehension tests" (but not that many authors have been resorting to such tests in the aphasiological literature!), and despite the fact that we are not anticipating any difficulty with such tasks, we have to wait before we can definitely discard the existence of *any* comprehension deficit in this patient.

6. LINGUISTIC PERFORMANCES: WRITTEN PRODUCTION AND OTHER TESTS-IMPLYING-WRITTEN-MATERIAL

6.1. *Written Narrative Discourse*

Within the context of the CLAS-Project, Mr. Clermont was asked to write the story of "Little Red Riding Hood." Therefore, it is mainly on such a basis that his written performance was assessed. Nevertheless, we have in addition a written version of the Story Completion Test (cf. supra) and some 20 pages of "spontaneous" written production which Mr. Clermont gave us for analysis. All these samples evidence the same pattern: (a) production of the same error types as those observed in oral narrative speech—i.e., omissions and substitutions of grammatical morphemes (substitutions being more frequent than omissions, though!)—but (b) fewer errors on the whole; (c) frequent crossing out of grammatical morphemes often followed by delayed self-corrections, not all successful, though.

Thus, even though Mr. Clermont had as much time as he wanted to

do such a task as writing "Little Red Riding Hood," many errors—of the same type as those previously observed in his oral production—remain in his "final version."

6.2. Dictation

Mr. Clermont's performance is normal (graphism and orthography included) in written word production on dictation. As far as sentence production is concerned, though, the same error pattern as that observed in written narrative discourse is evidenced, again despite the fact that the clinician gave him as much time as he wanted to do the task. Thus, the same dissociation as that observed in word vs. sentence repetition and reading is found in Mr. Clermont's writing to dictation.

6.3. Sentence Completion Test

Out of 30 written sentences of different complexity presented to him for oral completion, Mr. Clermont only makes two errors, both omissions (one of a preposition and one of a complementizer). In another test, made of 130 sentences with "homophonous" grammatical segments being left out ("ses"; "ces"; "c'est"), he only "forgets" to complete four sentences with the adequate written (this time) morphemes. There is thus a clearcut dissociation in his performances between his (in)capacity to process grammatical morphemes in all *sentence production* tasks and his capacity to produce these very same items in *sentence completion* tasks in which he limits his production to that of the "missing" element.⁸

6.4. Metalinguistic Tasks

Two metalinguistic tasks were proposed to Mr. Clermont: one involving "judgments of grammaticality" on written sentences ($N = 30$) including either omissions or substitutions of free-standing grammatical morphemes of all types; and another one aiming at the subcategorization of triads ($N = 13$) of grammatical morphemes (sous, "under" versus sur, "over" versus ses, "his"), the patient being asked to point at the morpheme which was "different" from the other two).

Mr. Clermont's performance is absolutely perfect on both tasks, a result which clearly indicates that, even though grammatical morphemes are often difficult to process in sentence production tasks and in connected discourse, adequate "abstract" knowledge about such items is still available to him.

6.5. Sentence Anagram Tasks

In a final attempt to answer the crucial question raised in the title of the present paper and even though Sentence Anagram Tasks go certainly

⁸ Since then, other Sentence Completion Tests have been devised to substantiate the existence of such a dissociation (see, Nespoulous et al., 1986).

far afield, away from (at least some of) the constraints of “real-life” on-line sentence production, two such tasks were devised. Each task comprised (the same) 20 target-sentences: 10 sentences with center-embedded clauses and 10 sentences with completives. In the first task (Task A), as in “standard” versions of such a test, Mr. Clermont was only given (on separate randomized cards) the written words necessary for the construction of each target-sentence (e.g., “La fille qui tire le chien porte une robe bleue”). In the second task (Task B) proposed to him a few days later, even though the target-sentences were still the same, two extra (and obviously erroneous) grammatical morphemes were added to each set of cards (for each sentence to be constructed); one of the two extra grammatical morpheme was systematically a “qui” or a “que” (i.e., an “intracategorical” distractors, the other extra morpheme being a pronoun, a preposition, or an article (i.e., an “intercategorical” distractor). If, as we hypothesized, Mr. Clermont had no problem whatsoever in generating (even complex) syntactic frames—i.e., if his deficit basically consisted of a reduced availability of closed-class items whenever they have to be inserted into such frames—our prediction was (1) that, in both tasks (A & B), our patient would manage to generate syntactically adequate structures but that (2), in task B, some (preferably “within category”) substitutions of grammatical morphemes might occur.

Results indicate

- that Mr. Clermont makes only two “within category” substitution errors in task B—in both cases on sentences of Type 7 (See Table 8—whereas the two normal subjects (of equivalent social and intellectual status) used as controls make no error;
- that, nevertheless, it takes longer for Mr. Clermont to get the correct responses than to the two normal subjects (three times as long, on average, in all tasks and on all sentences);
- that, it does take longer for Mr. Clermont to process sentences in which extra grammatical morphemes have been added (twice as long, on average) but the two normal subjects behave similarly.

In summary, not only is Mr. Clermont able to generate adequate syntactic frames in all tasks (A & B)—as expected—but he manages to select the correct grammatical morphemes (when a choice is given to him) in all cases but two—contrary to what we would have expected. This test thus further emphasizes the fact that Mr. Clermont is not incapable of generating (even) complex syntactic frames, even though it does take him more time than normal control subjects to do both sentence anagram tasks. Despite the difficulty one has to interpret unequivocally such differences in “processing times”—either as the outcome of an on-line syntactic problem or as the mere consequence of specific unavailability of free-standing grammatical morphemes—we will claim, pending further evidence

TABLE 8
SENTENCE ANAGRAM TEST A AND B

Sentence types	Sentence anagram A		Sentence anagram B	
	N. cont.	Mr. Clermont	N. cont.	Mr. Clermont
1. NP-VP	3"5	5"	5"	11"
2. NP-VP-PP	4"5	9"	12"	22"
3. NP-VP-PP with lexical prep.	6"5	9"	9"	30"
4. NP-NP-VP	8"	9"	8"	26"
5. NP-VP-NP-PP	7"	36"	16"	41"
6. NP-REL-VP	9"	30"	13"	40"
7. NP-NP-VP-NP-REL	2'38"	7'38"	1'55"	5'35"
8. Sentence with pro.	6"	9"	8"	45"
9. Passives	6"	27"	23"	35"
10. NP-VP-NP-PP with 2 argument verbs	6"	13"	16"	36"
11. NP-VP-PP with nonlexical prep.	6"	14"	8"	29"
12. Sentence with subord. clause	15"	2'43"	19"	49"

Note. But for two sentences of type 7 in Test B—where Mr. Clermont does not succeed in building up the expected structures, all anagrams are successfully solved by both the normal control (N. cont.) and the patient.

(Nespoulous et al., 1986), (a) that our patient's basic deficit is not specifically syntactic both at the level of knowledge and of actual—but unfortunately not on-line—processing and (b) that our test (particularly task B) was not sensitive enough to further substantiate the existence of a selective deficit affecting access processes to closed-class items in sentence production (Bates & Wulfeck, in press), maybe (again) because a sentence anagram task is far from tackling on-line processing constraints and limitations!

7. CONCLUSION

7.1. Localization of Lesions

Whatever one's definition of Broca's area, a lesion of "Broca's area" is no doubt what standard teaching would predict to have occurred in the case of Mr. Clermont: given that agrammatism is currently considered to belong with Broca's aphasia symptom complex, the fact that Mr. Clermont is a typical agrammatic should not change an iota to this prediction. As in at least one other nearly identical case (Kolk et al., 1985), ours does not abide by the doctrine (cf. *supra*). On the other hand, well documented anatomo-clinical observations of agrammatism are so few that, in our opinion, it remains an open question whether the case of

Mr. Clermont should in this respect—as well as, for that matter, with regard to the linguistic aspects of the case—be considered as an “exception” (Basso, Lecours, Moraschini, & Vanier, submitted).

7.2. *Mr. Clermont's Agrammatism*

In a tentative synthetic interpretation of all the data presented above, we will claim, for the time being

1. that the basic underlying deficit leading to the production of agrammatic sentences in this patient is not central, in Caramazza and Zurif's terms (1976), sentence comprehension appearing to be intact in all tests used, and all metalinguistic tasks being adequately done;
2. that such a deficit is not syntactic *at the level of knowledge*, contrary to what we originally thought (Nespoulous et al., 1984), if we correctly conclude from the sentence anagram tasks that, despite a processing time longer than that required by normal control subjects, Mr. Clermont is quite capable of building up (even complex) syntactic frames—at least when we tested him, after a few years of rehabilitation. Within the context of such an interpretation and if we consider that the increase in processing time in such a task might be primarily due to a lack of availability—or to a “delayed access” to—free-standing grammatical morphemes (cf. *infra*) and not to an on-line syntactic processing deficit, we are led to assume that the reduction in complexity of the sentences produced by the patient in connected discourse is the consequence of the coming into play of an adaptive strategy: syntactic structures would thus be simplified not because the most complex of them are inaccessible to the patient but because they require more grammatical morphemes (cf. *infra*.4.); but obviously more evidence is needed before such a conclusion can be retained if it ever can (cf. Kolk et al., 1985);
3. that such a deficit is not even syntactic *at the level of actual sentence production*, (a) at least in all the cases in which *complete* syntactic structures are adequately computed and produced and (b) considering the fact that all the erroneous substitutions of the deficit are *within category substitutions*. It is thus much easier to discard the possibility of a syntactic deficit when the patient wrongly selects grammatical morphemes than when he omits them (Bates et al., unpublished manuscript)!
4. that such a deficit does not, most of the time, reduce the paradigmatic availability of closed-class items in single-word production tasks. But here one must legitimately wonder what repetition and oral reading of *isolated* grammatical morphemes tell us about the processing of such items in the production of actual phrases and sentences: were such items disturbed in single-word production tasks, one could reasonably expect them to be disturbed in the production

of phrases and sentences; since such is not the case, one has to look for another explanation to account for Mr. Clermont's verbal behavior!

5. that, consequently, the deficit specifically disrupts the processing of free-standing grammatical morphemes whenever they have to be inserted into phrases and sentences, maybe because processing demands—temporal, mnemonic (cf. Mr. Clermont's performance in repetition of lists of open-class items *and* his performance in sentence repetition as opposed to his oral reading of the same sentences!) or otherwise—definitely increase when going from single-word production to phrasal and sentential production (and this even if the building up of syntactic frames remains available); Kolk's account of agrammatic production—in terms of "slower activation" or "faster decay"—might (?) be relevant for that matter (Kolk, in press; see also Gigley, 1983);
6. that the deficit is not only apparent, though, in "on-line"—time-constrained—oral sentence production tasks (!), but is still present in tasks without any strict time constraints such as written narrative discourse;
7. that the deficit is absent from almost any task involving more limited *processing load*, such as sentence completion tasks (when the patient only focuses upon—and produces—the missing element), maybe suggesting that "conscious," "restricted," and "strategic" processing is available to him in such tasks, a type of (limited-capacity) processing which is obviously unusable in all sentence and discourse production tasks, the latter requiring the smooth, rapid, and highly automatized activation of unconscious processes (Posner & Snyder, 1975) *which might thus be assumed to be at fault* in our patient. Such is at least the hypothesis we have recently raised in a new series of experiments with Mr. Clermont (Nespoulous et al., 1986);
8. that the deficit manifesting itself by omissions as well as substitutions (at least in all corpora gathered more than 5 years postonset)—the latter being even more frequent than the former in many tasks—the "classical" distinction between agrammatism and paragrammatism is not easy to handle in this case (Kolk, in press). Both manifestations being present in all tasks and the morphemes substituted here being the same as the ones omitted there (cf. Nespoulous et al., 1986), it seems reasonable to assume that omissions and substitutions are the "surface outcome" of a single underlying deficit (Kolk et al., 1985);
9. that, as made clear by the absence of clearcut preferential tendencies in substitution errors (e.g., substitutions of masculine and feminine articles are equal in number), the deficit does not seem to be constrained by specific linguistic structural properties such as "degree

of markedness." The only preferential pattern of errors that can be found in Mr. Clermont's verbal performances has to do with the fact that some grammatical morphemes are more frequently substituted than omitted (e.g., "Pro" pronouns), the reverse pattern being observed for other grammatical morphemes (e.g., "Cli" pronouns).

"I know perfectly well what I want to say. I find straight away the words I need. I know how to build up my sentences, but whenever I have to produce a grammatical word, even though I know very well that it is a preposition or an article . . . that I need, several of them come up to my mind and I never know for sure which one to produce." (Mr. Clermont's introspective⁹ account¹⁰ of his deficit.)

Mr. Clermont might be right, after all!

REFERENCES

- Alajouanine, Th. 1968. *L'aphasie et le langage pathologique*. Paris: Baillière.
- Basso, A., Lecours, A. R., Moraschini, S., & Vanier, M. Anatomico-clinical correlations of the aphasias as defined through computerized tomography: On exceptions. *Brain and Language*, 26, 201-229.
- Bates, E., Friederici, A., Wulfeck, B., & Juarez, L. A. On the preservation of syntax in aphasia: Cross-linguistic evidence. Unpublished manuscript.
- Bates, E., & Wulfeck, B. (in press). Cross-linguistic studies of aphasia. In B. MacWhinney, & E. Bates, (Eds.), *Cross-linguistic studies of sentence processing*. New York: Cambridge Univ. Press.
- Beauvois, M. F., & Dérouesne, J. 1981. Lexical or orthographic agraphia. *Brain*, 104(1), 21-49.
- Berndt, R., & Caramazza, A. 1980. A redefinition of the syndrome of Broca's aphasia: implications for a neuropsychological model of language. *Applied Psycholinguistics*, 1, 225-278.
- Bernheim, F. 1900. *De l'aphasie motrice*. Paris: Faculté de Médecine, Thèse.
- Bonhoeffer, K. 1902. Zur Kenntnis der Rückbildung motorischer Aphasien. *Mitteilungen aus den Grenzgebieten der Medizin und Chirurgie*, 10, 203-224.
- Bradley, D. 1983. *Computational distinctions of vocabulary type*. Bloomington: Indiana University Linguistics Club.
- Caplan, D., & Hildebrandt, N. (in press). *Disorders of syntactic comprehension*, Bradford Books.
- Caramazza, A., & Zurif, E. 1976. Dissociation of algorithmic and heuristic processes in language comprehension: Evidence from aphasia. *Brain and Language*, 3, 572-582.
- De Renzi, E., & Vignolo, A. 1962. The Token Test: A sensitive test to detect receptive disturbances in aphasics. *Brain*, 85, 665-678.
- Ducarne, B. 1965. *L'examen du langage*, Paris: Les Editions du Centre de Psychologie Appliquée.
- Friederici, A. 1982. Syntactic and Semantic Processes in Aphasia Deficits: The availability of prepositions. *Brain and Language*, 15, 249-258.
- Garrett, M. F. 1980. Levels of processing in sentence production. In B. Butterworth (Ed.), *Language production*. New York/London: Academic Press. Vol. 1.
- Gigley, H. M. 1983. HOPE-AI and the dynamic process of language behavior. *Cognition and Brain Theory*, 6, 39-87.

⁹ Note that while Mr. Clermont is fully aware of his substitutions, he never comments upon his frequent omissions of grammatical morphemes.

¹⁰ Mr. Clermont's comments have obviously been "completed" by us in order to make the readers' task easier.

- Goldstein, K. 1913. Ueber die Storungen der Grammatik bei Hirnkrankheiten. *Monatschrift fur Psychiatrie und Neurologie*, **34**, 540–568.
- Goodglass, H., Berko-Gleason, J., Bernholz, N. A., & Hyde, M. R., 1972. Some linguistic structures in the speech of a Broca's aphasic. *Cortex*, 191.
- Goodglass, H., & Kaplan, E. 1976. *The assessment of aphasia and related disorders*. Philadelphia: Lea & Febiger.
- Hannequin, D., Deloche, G., Branchereau, L., & Nespoulous, J.-L. 1986. *Noun-verb disambiguation in french and sentence comprehension in Broca's aphasics*. Paper presented at the Annual Meeting of the Academy of Aphasia, Nashville, October, 1986.
- Kean, M.-L. 1979. Agrammatism: A phonological deficit?. *Cognition*, **5**, 69–83.
- Kleist, K. 1916. Ueber Leitungsfasie und grammatische Storungen. *Monatschrift fur Psychiatrie und Neurologie*, **40**, 118–199.
- Kolk, H. (in press). Intentions and language pathology. To appear in G. Kempen (Ed.), *Natural language in generation. Advances in artificial intelligence, psychology and linguistics*. Dordrecht/Boston: Kluwer Academic Publishers.
- Kolk, H., & Van Grunsven, M.M.F. 1985. Agrammatism as a variable phenomenon. *Cognitive Neuropsychology*, **2**,(4), 347–384.
- Kolk, H.H.J., Van Grunsven, M.J.F., & Keyser, A. 1985. On parallelism in agrammatism: A case study. In M. L. Kean (Ed.), *Agrammatism*. Orlando, Academic Press.
- Lavallée-Huynh, G. 1975. *Echelle de complexité syntaxique établie expérimentalement à partir d'épreuves de mise en phrase chez des aphasiques de Broca*. Montréal: Département de Linguistique et Philologie, Thèse.
- Lecours, A.R., Lhermitte, F. et al. 1979. *L'aphasie*. Paris: Flammarion.
- Menn, L., & Obler, L. (Eds.). (in press). *Agrammatic aphasia. A cross-language narrative sourcebook*. Philadelphia, John Benjamins Publishing Company.
- Miceli, G., Mazzuchi, A., Menn, L., & Goodglass, H. 1983. Contrasting cases of italian agrammatic aphasia without comprehension disorder. *Brain and Language*, **19**, 65–97.
- Nespoulous, J.-L., Dordain, M., Perron, C., Bub, D., Caplan, D., Mehler, J., & Lecours, A.R. 1984. *Agrammatism in sentence production without comprehension deficits: Reduced availability of syntactic structures and/or of grammatical morphemes?* Paper presented at the Annual Meeting of the Academy of Aphasia, Los Angeles.
- Nespoulous, J.-L., Lecours, A.R., Lafond, D., Lemay, A., Puel, M., Joannette, Y., Cot, F., & Rascol, A. 1986. *Protocole Montréal-Toulouse d'examen linguistique de l'aphasie*. Montréal: Laboratoire Théophile Alajouanine.
- Nespoulous, J.-L., Dordain, M., Perron, C., Jarema, G., & Chazal, M. (in press). Agrammatism in French-speaking aphasics. In L. Menn & L. Obler (Eds.), *Agrammatic Aphasia: a cross-language narrative sourcebook*. Philadelphia, John Benjamins Publishing Company.
- Nespoulous, J.-L., & Dordain, M. 1986. *Variability, attentional(?) factors and "desautomatized" processing of grammatical morphemes in sentence production by an agrammatic patient*. Paper presented at the Annual meeting of the Academy of Aphasia, Nashville, October, 1986.
- Nespoulous, J.-L., & Dordain, M. (in preparation). The influence of syntactic complexity and/or of the number of grammatical morphemes on agrammatic performance.
- Posner, M.I., & Snyder, R.R. 1975. Attention and cognitive control. In R. Solso (Ed.), *Information processing and cognition. The Loyola Symposium*. Hillsdale, NJ: Erlbaum.
- Salomon, E. 1914. Motorische Aphasie mit Agrammatismus und sensorisch-agrammatischen Storungen. *Monatschrift fur Psychiatrie und Neurologie*, **35**, 181–275.
- Segui, J., Mehler, J., Frauenfelder, U., & Morton, J. 1982. The word frequency effect and lexical access. *Neuropsychologia*, **20**(6), 615–627.
- Zurif, E., Caramazza, A., & Myerson, R. 1972. Grammatical judgments of agrammatic aphasics. *Neuropsychologia*, **10**, 405–418.