Variation in the Pattern of Omissions and Substitutions of Grammatical Morphemes in the Spontaneous Speech of So-Called Agrammatic Patients

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We describe the patterns of omissions (and substitutions) of freestanding grammatical morphemes and the patterns of substitutions of bound grammatical morphemes in 20 so-called agrammatic patients. Extreme variation was observed in the patterns of omissions and substitutions of grammatical morphemes, both in terms of the distribution of errors for different grammatical morphemes as well as in terms of the distribution of omissions versus substitutions. Results are discussed in the context of current debates concerning the possibility of a theoretically motivated distinction between the clinical categories of agrammatism and paragrammatism and, more generally, concerning the theoretical usefulness of any clinical category. The conclusion is reached that the observed heterogeneity in the production of grammatical morphemes among putatively agrammatic patients renders the clinical category of agrammatism, and by extension all other clinical categories from the classical classification scheme (e.g., Broca’s aphasia, Wernicke’s aphasia, and so forth) to more recent classificatory attempts (e.g., surface dyslexia, deep dysgraphia, and so forth), theoretically useless. © 1989 Academic Press, Inc.

Historically, aphasia research has attempted to answer questions of the following sort: What are the neuroanatomical structures associated

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with such and such a syndrome? Or, what are the cognitive/linguistic mechanisms that are damaged in such and such a syndrome? This approach to the study of aphasia, as the basis for inferring the structure of normal language processing, has recently been challenged on the grounds that it cannot lead to meaningful, theoretically interpretable results (Caramazza, 1984, 1986; Marshall, 1986). The principal objection concerns the dependence of this approach on the notion "syndrome." Research based on this approach requires that the clinically identified syndromes constitute natural-kind categories which can serve as the basis for the a priori description and selection of the exemplars of such categories. Clinical syndromes cannot play such a role, however.

Recently it has been shown that valid inferences about the structure of normal cognitive processing from impaired performance crucially depend on the prior identification of the functional lesion(s) in a damaged cognitive system. But the identification of a functional lesion to a damaged cognitive system is only possible a posteriori, that is, on the basis of all the theoretically relevant evidence for each brain-damaged patient. On this account, there is no arbitrarily large subset of a patient's performance, short of all the theoretically relevant evidence, which can serve as the basis for the identification of a functional lesion to a cognitive system (Caramazza, 1986). A major implication of this analysis is that variation in performance within a clinical type cannot be assumed, a priori, to be theoretically unimportant. Consequently, clinical categories, such as Broca's aphasia, deep dyslexia, phonological dysgraphia, and so forth, cannot serve as the basis for theoretically meaningful research.

The implications of these metatheoretical developments were extensively analyzed in Badecker and Caramazza (1985; see also Caramazza, 1988) specifically for the case of agrammatism. These authors argued that the clinical category agrammatism cannot serve as the basis for theoretical statements about the nature of normal language processes nor for claims about the nature of the language mechanisms that are presumably damaged in so-called agrammatic patients. Specifically, Badecker and Caramazza argued that agrammatism is an ill-defined concept which does not allow the specification of an homogeneous patient population (or the selection of an homogeneous patient group) over which we may base theoretical claims.

The conclusion reached by Badecker and Caramazza (1985) has been challenged by Caplan (1986) who maintains that the variation in performance that characterizes the (putative) category of agrammatism "... actually constitutes evidence in favor of a general syndrome of agrammatism, since the variation they [Badecker & Caramazza] cite can largely be explained..." (p. 266; his emphasis). Caplan appeals to Kean's (1977) and Lapointe's (1985) work in support of his contention that significant
aspects of the clinically classified agrammatic's variation in speech performance can be explained within a general theory of "agrammatism." However, the latter two authors were only concerned with the putative existence of a hierarchy of production difficulty for different grammatical morphemes; they were not concerned with performance variability across types of grammatical morphemes in different patients of the putatively same category—i.e., these authors were not directly concerned with the issue Caplan identifies as the problem of "profiles of agrammatism." Caplan recognizes that the existence of this latter type of variability presents a major problem for the view that "agrammatism" constitutes a theoretically coherent cognitive category. Nonetheless, he goes on to appeal to the abstract notion of "adaptation/compensatory mechanisms" to explain this variability. This latter appeal remains without force, however, since it is unaccompanied by any concrete proposal concerning the nature of these compensatory mechanisms.

But, what is the range of performance variation that must be accounted for by any proposal that posits "agrammatism" as a coherent cognitive category? Important as this question is for any serious account of the putative category "agrammatism," there is surprisingly a dearth of adequate information (with some notable exceptions, e.g., de Villiers, 1978) on which to base informed discussion of this issue. The principal scope of this paper is to remedy this situation—that is, to consider the range of production deficits involving the omission or substitution of grammatical morphemes in patients clinically classified as agrammatic.

Since the principal issue under consideration in this paper concerns the contentious issue of performance variability across a putatively coherent patient category, it is crucial that the criteria for the selection of the patients to be analyzed be above suspicion; that is, the patients included in the analysis must be manifestly agrammatic on current criteria for identification of this disorder. Furthermore, since language differences (e.g., whether or not inflections attach to words or stems) may interact with the form taken by the agrammatic disorder, we have restricted our analysis to Italian patients. Finally, in order to obtain a fair representation of the variability of the disorder, we have analyzed the performance of a large number of clinically classified agrammatic patients (N = 20).

Agrammatism is defined as a disorder of sentence production characterized by the selective omission of freestanding and bound grammatical morphemes. This definition of the disorder, in particular that aspect concerning the omission of bound grammatical morphemes, while appropriate for a language like English which attaches inflections to words, is not adequate for a language like Italian which attaches inflections to stems. For languages of the latter type the omission of a word's inflection would result in a nonword (compare walking → walk vs. portare (to carry) → *port, where walk is a word of English but port is not a word
in Italian). Indeed, there are no reports of Italian patients who systematically omit bound morphemes and produce uninflected nonwords. In light of this language-specific feature of Italian the definition of agrammatism used to select patients for the study reported here was modified as follows: Agrammatism is a disorder of sentence production characterized by the omission of freestanding grammatical morphemes with or without the substitution of bound grammatical morphemes.

SUBJECTS

Right-handed brain-damaged patients in stable neurological condition, without disorders of "consciousness," with a history of acute disturbance of language functions, without neuropsychological signs of diffuse mental deterioration, and who had received a formal education for at least 5 years were considered for inclusion in the present study.

Of the subjects who fulfilled the general requirements detailed above, only those who conformed to a clinical (intuitive) characterization of agrammatism as presented in the literature were included. The linguistic criterion for inclusion in the present research was the production of grammatically ill-formed sentences, containing omissions of freestanding grammatical markers with or without substitutions of bound grammatical markers in spontaneous speech.

Of the 20 subjects included in the present research, one is a crossed aphasic (C.S.). Patients G.G. and T.F. have already been described in Miceli, Mazzucchi, Menn, and Goodglass (1983); patients C.D.A. and F.G. have been described in Miceli and Mazzucchi (1988), where they are referred to as Mr. Rossi and Mr. Verdi, respectively; patient F.S. is described in Miceli and Caramazza (1988).

In addition to the aphasic patients, 10 control subjects, roughly matched for age and education to the aphasic patients, were asked to collaborate in the study. The control subjects were either outpatients at the Clinica Neurologica del Sacro Cuore, Rome, or spouses of the patients who participated in this study.

The essential biographic information and lesion data for the 20 patients who participated in the present study are presented in Table 1. The subjects are indicated by their initials. They are listed in alphabetical order according to the second letter of their initials, which corresponds to their last name.

MATERIALS AND METHODS

The speech corpora analyzed for this paper were collected by asking our subjects to produce the following narratives: history of illness, activities of daily life, The Little Red Riding Hood, descriptions of the Cookie Theft picture (Goodglass & Kaplan, 1972). Patients F.B., G.D.C., C.D.A., F.G., C.D., and A.M., and four normal controls also provided a description of the four stories of the original Wechsler–Bellevue Test.

The examiner asked each patient (and each control subject) to produce a given narrative.
TABLE I
ESSENTIAL BIOGRAPHICAL INFORMATION ON THE PATIENTS INCLUDED IN THE STUDY

<table>
<thead>
<tr>
<th>Subject</th>
<th>Age at onset</th>
<th>Years of formal education</th>
<th>Etiology</th>
<th>Lesion site</th>
<th>Time Postonset</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.A.</td>
<td>34</td>
<td>7</td>
<td>Aneurysm</td>
<td>F</td>
<td>1 year</td>
</tr>
<tr>
<td>F.A.</td>
<td>63</td>
<td>8</td>
<td>Meningioma</td>
<td>F (P)</td>
<td>5 years</td>
</tr>
<tr>
<td>F.B.</td>
<td>24</td>
<td>14</td>
<td>Trauma</td>
<td>F</td>
<td>3 years</td>
</tr>
<tr>
<td>C.D.</td>
<td>59</td>
<td>11</td>
<td>CVA</td>
<td>Deep F</td>
<td>4 years</td>
</tr>
<tr>
<td>F.D.</td>
<td>59</td>
<td>19</td>
<td>CVA</td>
<td>T (bilat)</td>
<td>1 year</td>
</tr>
<tr>
<td>C.D.A.</td>
<td>45</td>
<td>17</td>
<td>Aneurysm</td>
<td>TP</td>
<td>2 years</td>
</tr>
<tr>
<td>G.D.C.</td>
<td>50</td>
<td>5</td>
<td>CVA</td>
<td>FTP</td>
<td>8 years</td>
</tr>
<tr>
<td>E.D.U.</td>
<td>59</td>
<td>17</td>
<td>CVA</td>
<td>—</td>
<td>1 year</td>
</tr>
<tr>
<td>G.F.</td>
<td>58</td>
<td>19</td>
<td>CVA</td>
<td>TP</td>
<td>3 weeks</td>
</tr>
<tr>
<td>T.F.</td>
<td>38</td>
<td>5</td>
<td>CVA</td>
<td>Deep P</td>
<td>1 day</td>
</tr>
<tr>
<td>F.G.</td>
<td>21</td>
<td>15</td>
<td>CVA</td>
<td>Deep FP</td>
<td>2 years</td>
</tr>
<tr>
<td>G.G.</td>
<td>58</td>
<td>8</td>
<td>CVA</td>
<td>F</td>
<td>1 year</td>
</tr>
<tr>
<td>M.L.</td>
<td>35</td>
<td>13</td>
<td>Cardiac arrest</td>
<td>neg CT</td>
<td>7 years</td>
</tr>
<tr>
<td>A.M.</td>
<td>53</td>
<td>8</td>
<td>CVA</td>
<td>TP</td>
<td>4 years</td>
</tr>
<tr>
<td>M.M.</td>
<td>50</td>
<td>5</td>
<td>CVA</td>
<td>—</td>
<td>1 year</td>
</tr>
<tr>
<td>B.P.</td>
<td>49</td>
<td>8</td>
<td>CVA</td>
<td>FTP</td>
<td>9 years</td>
</tr>
<tr>
<td>C.S.</td>
<td>68</td>
<td>13</td>
<td>CVA</td>
<td>Right FP</td>
<td>1 year</td>
</tr>
<tr>
<td>F.S.</td>
<td>57</td>
<td>17</td>
<td>CVA</td>
<td>Deep FT</td>
<td>5 years</td>
</tr>
<tr>
<td>L.S.</td>
<td>37</td>
<td>5</td>
<td>Meningioma</td>
<td>F</td>
<td>1 year</td>
</tr>
<tr>
<td>M.U.</td>
<td>47</td>
<td>13</td>
<td>CVA</td>
<td>—</td>
<td>1 year</td>
</tr>
</tbody>
</table>

* See Appendix.

Once the patient began producing a narrative, communication on the examiner's part was limited to nods. Severely impaired patients were encouraged if they appeared to be too frustrated by the task, or, if necessary, were asked open questions of the type "Could you tell me more?"

Speech samples, collected over several sessions, were tape-recorded on high-quality cassettes. The tapes were independently transcribed by two of the authors of the present study. The few disagreements between the two transcriptions were adjudicated by a third person who independently listened to the problematic taped sequence. Sequences which could not be resolved unambiguously were omitted from the final transcript.

Phonetic and phonemic distortions were ignored—the "intended" target response was transcribed. If the patient made more than one attempt at producing a word, only the last attempt was transcribed. This criterion was used both for content words and function words. Fillers ("Well," "Let's see," "Wait," etc.) and stereotyped sentences used to fill word-finding pauses ("I don't know," "What's its name," etc.) were excluded from word counts.

**Scoring Procedures**

The quantitative measures used in the present study are reported and described below. Agrammatic speakers frequently produce fragmented utterances, i.e., strings of words in which the intended grammatical structure cannot be reconstructed. In order to quantify this feature of our patients' speech, the proportion of words produced in fragmented utterances was calculated for each subject. It was decided to consider as fragmented
utterances all false starts and all those sequences of words that could not unambiguously be considered as attempts to produce a sentence. The following is an example of the latter type of fragmented speech produced by a patient who was trying to tell the history of illness (periods in the transcript stand for pauses of more than 3 sec):

"Commune . . . invece . . . aspetta, eh . . . carta . . . scritto . . . medico . . ."

"Town Hall . . . instead . . . wait, eh . . . paper . . . written . . . doctor . . ."

The quantitative incidence of fragmented speech is expressed as the ratio of the number of words produced without a recoverable grammatical structure to the total number of words in the sample (produced either correctly or incorrectly, with or without a recoverable grammatical structure). Small values of this ratio indicate a relative paucity of fragmented speech.

The mean length of utterance (MLU) was calculated on the corpus retained after elimination of fragmented speech, according to two distinct criteria: a lexical and a morphological criterion (MLU-Lexical and MLU-Morphological, respectively). MLU-Lexical corresponds to the number of major-class items produced by the patient in an uninterrupted, syntactically correct string. The end of an utterance according to this criterion was marked by the omission of a major-class lexical item, by prosodic criteria (only in patients whose prosody was not flat), or by a major pause (longer than 3 sec). MLU-Morphological was calculated on the basis of the number of uninterrupted, syntactically and morphologically well-formed strings of words. The end of an utterance according to this criterion was marked by the omission of a major-class lexical item, by prosodic criteria, or by a major pause, as in the case of MLU-Lexical, but also by the omission or substitution of a freestanding grammatical marker, or by the substitution of a bound grammatical marker. Take for example a sentence like "Tre volte [a] settimana io scrive una lettera" (roughly corresponding in English to the sentence "Three times [a] week I writes a letter"). For the MLU-Lexical count, this sentence would count as one utterance of length 7. For the MLU-Morphological count, however, the sentence would count as three utterances of length 2, 3, and 2, due to the omission of a freestanding grammatical morpheme (in brackets) and to the substitution of a bound grammatical morpheme ("scrive" is the present indicative, 3rd singular form, and was produced in a context where the 1st singular form was called for).

Filler sentences or frozen expressions, of the type "I do not know," "What's its name," and the like were not counted when calculating MLUs.

a. Single-word level analyses. Several counts were conducted to quantify the disorder of grammatical morphemes and content word production in our patient sample.

The set of content words included nouns, adjectives, and main (lexical) verbs. Adverbs were excluded from the counts of content words, because only a few of the patients retained the ability to produce them. When a verb was of the form aux + V-ato—the perfect tense composed of the have or be plus past participle as in "Ho parlato" (I have spoken)—aux was scored as a function word (see below), and V + ato as a main verb.

Several measures were considered. The first, Content Word Omission Rate, is an index which captures the rate of omission of major class lexical items in obligatory context. Some examples will clarify this criterion. Instances of missing arguments without indications of anomic difficulties (such as long pauses or intervening "I don't know" sentences) were counted as omissions of a major-class lexical item. Two examples of this type of speech production errors are the sentences "Il bambino da alla bambina" (The boy gives to the girl), or "Il bambino mette" (The boy puts). By the same token, instances of nonpermissible subject deletion were considered as omissions of a content word (e.g., "Il grano cresce e guarda il punto di maturazione" (The corn grows and watches the degree of maturation), where the context unequivocally establishes that "il contadino" (the farmer) is the subject of "guarda" (watches)). Instances where sequences of two or more nouns were produced without an intervening main verb, but where the nouns were obviously related to each other as indicated by context, prosodic features, or by gestures made by the patient, were
counted as verb omissions. By contrast, clear-cut instances of word-finding difficulty, like "Il cane mangia la . . . come si dice?" (The dog eats the . . . what's its name?) were not counted as omissions of a noun, but were considered as interruptions of (otherwise well-formed, in the case) syntactic strings. This last type of error was infrequent in our samples.

The set of Bound Grammatical Morphemes included nominal, adjectival, and verbal inflections. The Bound Grammatical Morpheme Substitution Rate was based on the occurrences of incorrect nominal, adjectival, and verbal inflections.

The set of Freestanding Grammatical Morphemes included prepositions, definite and indefinite articles, clitics, and auxiliaries. This set of words did not include the following items:

(1) subordinate conjunctions, because only some patients retained the ability to produce them, and we wanted to compare the patients on the ability to produce a subset of grammatical markers that they were all able to use;

(2) indefinite pronouns, possessive pronouns, and quantifiers, partly for the same reasons as (1), partly because in Italian it is very difficult to establish the occurrence of an obligatory context for these items;

(3) strong pronouns, because of the disagreement regarding their placement in the category of grammatical morphemes;

(4) main have/be verbs.

For Freestanding Grammatical Morphemes, the following measures were obtained: Freestanding Grammatical Morpheme Omission Rate: omissions of free-standing grammatical morphemes in obligatory context; Freestanding Grammatical Morpheme Substitution Rate: substitutions of freestanding grammatical morphemes in obligatory context.

b. Analyses of agreement relations. Given the complexity of its morphological system, Italian offers an excellent opportunity to evaluate the incidence and the qualitative aspects of disorders of grammatical agreement in patients with disorders of speech production. We assessed the following agreement violations:

(i) Violations of determiner–noun agreement: Only mismatches between determiner (det) and noun were counted, i.e., instances where det and noun did not agree for gender and/or number (e.g., il bambina—the (m.sg.) girl (f.sg.); il bambini—the (m.sg.) boys; il bambine—the (m.sg.) girls (f.pl.). The few instances in which the lexical gender and/or number of the noun was incorrect, but the determiner agreed with the incorrect gender and/or number, were counted as instances of correct agreement (e.g., la studia*—the (f.sg.) office (f.sg.*), where the correct form would have been lo studio—the (m.sg.) office (m.sg.); i bambini—the (m.pl.) boys (m.pl.), in a context where "il bambino"—the (m.sg.) boy (m.sg.)—should have been produced). Substitutions of the incorrect for the correct allomorph of the definite article were counted separately and were not considered as agreement violations (e.g., "lo rubinetto" for "il rubinetto" (the faucet), where both "il" and "lo" are m.sg. definite articles but are used in different phonological contexts—"lo" is used with nouns and adjectives that begin with a vowel sound or certain consonant clusters).

(ii) Violations of noun-adjective agreement: The same general principles as in (i) were applied, i.e., only mismatches between nominal and adjectival inflection were considered to be instances of agreement violation. Again, for the few cases where lexical gender and/or number of the noun was incorrect, but the adjective carried the inflection appropriate for the incorrect noun suffix, these were not considered as errors of agreement. Thus, for example, "il bambino bionda" (the boy—m.sg.—blonde—f.sg.) and "il bambino biondi" (the boy—m.sg.—blonde—m.pl.) were instances of agreement violation, whereas "la mia studia" (the my—f.sg.—office—incorrect f.sg., should be "studio," m.sg.) and "i miei studi" (the my—m.pl.—offices—m.pl.—, in a context where the m.sg. would be required) were not scored as agreement errors. Furthermore, NPs containing cardinal numeral adjectives
were excluded when scoring agreement violations. This step was taken because only some patients (but not others) made extensive use of these adjectives.

(iii) Subject–verb agreement: Verb inflections inappropriately marked for person and/or number were scored as agreement errors. However, analogously to (i) and (ii), if the subject was produced in the incorrect number and the verb agreed in person with the subject, this was not considered an agreement error. Thus, utterances like “Il bambino corrono” (The boy run—3 pl., number error) and “Il bambino corrì” (The boy run—2 sg., person error) were considered agreement errors, whereas “Cappuccetti Rossi corrono” (The Little Red Riding Hoods run—3 pl.) was not. Errors in the production of verb aspect and/or tense were considered separately from agreement errors. Aspect and tense errors were grouped under the category “verb morphology errors.” We recognize the arbitrary nature of the distinction drawn here—although tense and aspect errors cannot be agreement errors, the errors we have labeled agreement errors need not result from an inability to appreciate agreement relations but may only reflect difficulties in selecting the proper inflectional form (just like the other “verb morphology” errors).

ANALYSIS OF RESULTS

The size of the speech sample collected from each subject, speech rate (measured as the number of words per minute produced by the patient), and the presence or absence of dysarthria (assessed solely on clinical criteria) are reported in Table 2. Table 2 also reports information on sample size and speech rate for normal controls. For normal controls only, average values and ranges are reported.

Estimates of patients’ speech rates were obtained by averaging over several 1-min samples selected through quasi-random sampling of each patient’s speech corpus. Two constraints were respected in the sampling procedure: (1) the chosen sample was free of interruptions by the examiner (with questions or comments) and, (2) the sample was free of clear anemic pauses. All the words produced by the patient in each section were counted, including frozen expressions and words produced out of grammatical context (see under Incidence of fragmented speech, below).

The results reported in Table 2 are relevant to the classical concern with the relationship that may obtain among agrammatism, dysarthria, and reduced speech rate. It has traditionally been held that the three disorders co-occur. The putative co-occurrence of these deficits provided the empirical basis for the “economy of effort” hypotheses of “agrammatism,” from Isserlin (1922) to Lenneberg (1967)—speech articulation is so laborious in these patients that they reduce their output to just the most essential, communicative elements, thus avoiding “unnecessary” words, i.e., freestanding grammatical markers. The results in Table 2 demonstrate that, although the co-occurrence of agrammatism (defined as the omission of freestanding grammatical morphemes), reduced speech rate (measured by the number of words produced per minute), and dysarthria (clinically defined as the simplification of consonant clusters in words) reflect a statistical effect, the putative co-occurrence is not functionally necessary. Although in a number of our patients (A.A., F.A.,
TABLE 2
SIZE OF THE SPEECH CORPUS COLLECTED FROM EACH PATIENT, PRESENCE OF DYSARTHRIA, AND SPEECH RATE

<table>
<thead>
<tr>
<th>Subject</th>
<th>Sample size</th>
<th>Dysarthria</th>
<th>Speech rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.A.</td>
<td>118</td>
<td>+</td>
<td>49</td>
</tr>
<tr>
<td>F.A.</td>
<td>313</td>
<td>+</td>
<td>66</td>
</tr>
<tr>
<td>F.B.</td>
<td>394</td>
<td></td>
<td>55</td>
</tr>
<tr>
<td>C.D.</td>
<td>1214</td>
<td>+</td>
<td>52</td>
</tr>
<tr>
<td>F.D.</td>
<td>1123</td>
<td></td>
<td>73</td>
</tr>
<tr>
<td>C.D.A.</td>
<td>708</td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>G.D.C.</td>
<td>197</td>
<td>+</td>
<td>34</td>
</tr>
<tr>
<td>E.D.U.</td>
<td>780</td>
<td></td>
<td>84</td>
</tr>
<tr>
<td>G.F.</td>
<td>362</td>
<td></td>
<td>81</td>
</tr>
<tr>
<td>T.F.</td>
<td>460</td>
<td></td>
<td>96</td>
</tr>
<tr>
<td>F.G.</td>
<td>488</td>
<td>+</td>
<td>29</td>
</tr>
<tr>
<td>G.G.</td>
<td>328</td>
<td>+</td>
<td>23</td>
</tr>
<tr>
<td>M.L.</td>
<td>390</td>
<td>+</td>
<td>81</td>
</tr>
<tr>
<td>A.M.</td>
<td>481</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>M.M.</td>
<td>433</td>
<td></td>
<td>38</td>
</tr>
<tr>
<td>B.P.</td>
<td>227</td>
<td>+</td>
<td>32</td>
</tr>
<tr>
<td>C.S.</td>
<td>199</td>
<td>+</td>
<td>54</td>
</tr>
<tr>
<td>F.S.</td>
<td>749</td>
<td>i</td>
<td>67</td>
</tr>
<tr>
<td>L.S.</td>
<td>270</td>
<td></td>
<td>44</td>
</tr>
<tr>
<td>M.U.</td>
<td>328</td>
<td>+</td>
<td>61</td>
</tr>
</tbody>
</table>

Norm (range) 526–936 108–122
Norm (avg.) 697 117

C.D., C.D.A., G.D.C., F.G., G.G., B.P., C.S., F.S.) agrammatism, reduced speech rate, and dysarthria are associated, other patients in our series display a behavioral pattern that is at variance with the classical description. Patient A.M., for example, displays a severely reduced speech rate (20 words per minute) and a fairly high rate of omission of freestanding grammatical markers, but no dysarthria at all—in fact, he speaks with an impeccable, standard Italian pronunciation; patient F.B. presents with a similar pattern of performance, although her speech rate (55 words per minute) is less reduced than A.M.'s. Patients T.F. and G.F. show the most interesting dissociation: a very high rate of omission of freestanding grammatical morphemes with a total absence of dysarthria and a speech rate (96 and 81 words per minute, respectively) that is not far from the normal range. Indeed, when we consider that the word count for these patients consisted primarily of content words, which on the average are longer than function words, the discrepancy in speech rate between these two patients and the normal controls is further reduced.
One pattern of performance—the co-occurrence of dysarthria and reduced speech rate without omission of free-standing grammatical morphemes—could not be found in our patient series because we only considered patients who omitted function words in spontaneous speech. However, the dissociation has been reported in the literature (see Schiff, Alexander, Naeser, & Galaburda, 1983, for a review). The dissociations we have reported together with those already described in the literature conclusively demonstrate, if there still was any need, that the co-occurrence of agrammatism, reduced fluency, and dysarthria, although not infrequent, is by no means functionally necessary.

1. Incidence of Fragmented Speech in our Agrammatic Speakers

A common feature of so-called agrammatic speech is the presence of "fragmented speech"—operationally defined here as those utterances for which it is not possible to recover the intended grammatical structure. The presence of fragmented utterances in these patients' speech considerably complicates the analysis of the grammatical structure of their speech, and for this reason speech samples were pruned of fragments prior to further analysis. The incidence of fragmented speech in each patient is shown in Table 3.

The proportion of fragmented utterances in the speech of our patients varied considerably. To mention only extreme examples, the proportion of fragmented utterances in the speech of patients F.D., T.F., and F.G. fell within the range observed in normal controls (and the value for patient G.G. was only marginally higher). By contrast, in the case of patients A.S. (.40), B.P. (.39), G.D.C. (.33), and M.U. (.32), the proportion of fragmented utterances was very high. It is unclear to us what weight to assign to the extreme differences in the production of fragmented utterances in the speech of our "agrammatic" sample. We have chosen to downplay the importance of these differences, and all further analyses, unless otherwise indicated, are based on the speech samples from which fragmented utterances have been removed.

2. The MLU Produced by Our Agrammatic Speakers

MLU may be taken as a gross index of a patient's sentence production. However, as we have argued elsewhere (Badecker & Caramazza, 1986; Miceli & Mazzucchi, 1988) this measure is of suspect theoretical import, since its value can be determined by a number of totally independent impairments of the speech production system (phonological, lexical, syntactic, morphological). Nonetheless, we have chosen to report MLU information as a descriptive means to capture some of the gross differences in our patients' speech.

As stated under Materials and Methods, two different MLUs were calculated for each patient (MLU-Lexical and MLU-Morphological). MLU-
TABLE 3
INCIDENCE OF FRAGMENTED SPEECH OBSERVED IN EACH PATIENT

<table>
<thead>
<tr>
<th>Subject</th>
<th>F.S.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.A.</td>
<td>.40</td>
</tr>
<tr>
<td>F.A.</td>
<td>.08</td>
</tr>
<tr>
<td>F.B.</td>
<td>.18</td>
</tr>
<tr>
<td>C.D.</td>
<td>.04</td>
</tr>
<tr>
<td>F.D.</td>
<td>.01</td>
</tr>
<tr>
<td>C.D.A.</td>
<td>.09</td>
</tr>
<tr>
<td>G.D.C.</td>
<td>.33</td>
</tr>
<tr>
<td>E.D.U.</td>
<td>.06</td>
</tr>
<tr>
<td>G.F.</td>
<td>.10</td>
</tr>
<tr>
<td>T.F.</td>
<td>.01</td>
</tr>
<tr>
<td>F.G.</td>
<td>.01</td>
</tr>
<tr>
<td>G.G.</td>
<td>.02</td>
</tr>
<tr>
<td>M.L.</td>
<td>.06</td>
</tr>
<tr>
<td>A.M.</td>
<td>.06</td>
</tr>
<tr>
<td>M.M.</td>
<td>.20</td>
</tr>
<tr>
<td>B.P.</td>
<td>.39</td>
</tr>
<tr>
<td>C.S.</td>
<td>.18</td>
</tr>
<tr>
<td>F.S.</td>
<td>.04</td>
</tr>
<tr>
<td>L.S.</td>
<td>.21</td>
</tr>
<tr>
<td>M.U.</td>
<td>.32</td>
</tr>
<tr>
<td>Normals (range)</td>
<td>.00-.01</td>
</tr>
<tr>
<td>Normals (avg.)</td>
<td>.003</td>
</tr>
</tbody>
</table>

* Expressed as number of words produced without a recoverable grammatical structure/total number of words in the speech sample.

Lexical is an index of the mean number of "syntactically appropriate," consecutively produced words, ignoring errors of morphology (e.g., agreement errors). MLU-Morphological refers to the mean length of word strings which are both syntactically and morphologically correct.

The MLUs reported here were obtained from the analysis of the syntactically structured speech produced by each patient—that is, excluding fragmented utterances. The values of MLU-Lexical and of MLU-Morphological obtained for each patient are shown in Table 4.

Patients' speech production performance as indexed by MLU-Lexical and MLU-Morphological is extremely variable. Thus, when considering MLU-Lexical, 3 of our 20 subjects (C.D., T.F., and M.L.) fall within the normal range, with T.F. scoring in the upper normal range, whereas the four most impaired subjects (A.A., G.D.C., C.D.A., and A.M.) obtained MLU-Lexical values in the range 3.10 to 3.37 words, considerably below the normal range. As expected, none of our agrammatic speakers are within the normal range for MLU-Morphological. M.L. is the only patient
TABLE 4

Mean length (lexical and morphological) of the utterances produced by the patients included in the study, and ratio of the mean length of lexically vs. morphologically intact strings

<table>
<thead>
<tr>
<th></th>
<th>M.L.U.-Lexical</th>
<th>M.L.U.-Morphological</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.A.</td>
<td>3.10</td>
<td>2.40</td>
<td>0.78</td>
</tr>
<tr>
<td>F.A.</td>
<td>6.06</td>
<td>3.69</td>
<td>0.61</td>
</tr>
<tr>
<td>F.B.</td>
<td>4.15</td>
<td>3.74</td>
<td>0.90</td>
</tr>
<tr>
<td>C.D.</td>
<td>7.32</td>
<td>4.72</td>
<td>0.64</td>
</tr>
<tr>
<td>F.D.</td>
<td>6.55</td>
<td>4.07</td>
<td>0.62</td>
</tr>
<tr>
<td>C.D.A.</td>
<td>3.25</td>
<td>2.33</td>
<td>0.72</td>
</tr>
<tr>
<td>G.D.C.</td>
<td>3.14</td>
<td>2.13</td>
<td>0.68</td>
</tr>
<tr>
<td>E.D.U.</td>
<td>6.65</td>
<td>4.21</td>
<td>0.63</td>
</tr>
<tr>
<td>G.F.</td>
<td>4.55</td>
<td>2.46</td>
<td>0.54</td>
</tr>
<tr>
<td>T.F.</td>
<td>10.50</td>
<td>3.60</td>
<td>0.34</td>
</tr>
<tr>
<td>F.G.</td>
<td>4.69</td>
<td>3.69</td>
<td>0.79</td>
</tr>
<tr>
<td>G.G.</td>
<td>4.40</td>
<td>2.90</td>
<td>0.66</td>
</tr>
<tr>
<td>M.L.</td>
<td>7.44</td>
<td>6.06</td>
<td>0.81</td>
</tr>
<tr>
<td>A.M.</td>
<td>3.37</td>
<td>2.67</td>
<td>0.79</td>
</tr>
<tr>
<td>M.M.</td>
<td>4.68</td>
<td>3.45</td>
<td>0.74</td>
</tr>
<tr>
<td>B.P.</td>
<td>3.95</td>
<td>2.18</td>
<td>0.55</td>
</tr>
<tr>
<td>C.S.</td>
<td>4.26</td>
<td>3.38</td>
<td>0.79</td>
</tr>
<tr>
<td>F.S.</td>
<td>6.11</td>
<td>3.16</td>
<td>0.52</td>
</tr>
<tr>
<td>L.S.</td>
<td>4.00</td>
<td>2.71</td>
<td>0.68</td>
</tr>
<tr>
<td>M.U.</td>
<td>4.70</td>
<td>3.50</td>
<td>0.74</td>
</tr>
<tr>
<td>Normals (range)</td>
<td>6.70–13.01</td>
<td>6.65–13.01</td>
<td>0.96–1</td>
</tr>
<tr>
<td>Normals (avg.)</td>
<td>8.39</td>
<td>8.35</td>
<td>0.99</td>
</tr>
</tbody>
</table>

whose MLU-Morphological value is reasonably close to the values obtained by normal subjects—6.06 vs. 6.65; furthermore, 8 of our subjects display a MLU-Morphological of less than 3.0 words.

Our selection criteria for inclusion of patients in this study necessarily requires that patients' MLU-Morphological be shorter than their MLU-Lexical—after all, patients were included in the study only if they omitted freestanding grammatical morphemes. Thus, the mere discrepancy between MLU-Morphological and MLU-Lexical scores is not informative. The relative difference between these scores is not unimportant, however—it represents a gross index of sentence processing difficulty. That is, we may take a large discrepancy between MLU-Lexical and MLU-Morphological as an index of the degree of difficulty a patient presents within the production of context-appropriate morphology. Inspection of the ratio of MLU-Morphological to MLU-Lexical values reveals major differences. Some patients (F.B., M.L., A.M., C.S., A.A.) obtained ratios ranging from 0.78 to 0.90, reflecting minimal morphological processing difficulties.
By contrast, patient T.F., and to a lesser extent patients F.S., G.F., and B.P., present with severe difficulties in morphological processing (ratios of 0.34, 0.52, 0.54, and 0.55, respectively). This observation clearly indicates that our patients differ in the extent to which their ability to use free-standing and bound grammatical morphemes in spontaneous speech is impaired. The remainder of this paper will focus on the quantitative and qualitative analysis of these individual differences in grammatical morpheme production.

3. Patterns of Errors on Freestanding Grammatical Morphemes

The crucial, distinguishing feature of agrammatism is the relative omission of freestanding grammatical morphemes. The patients included in our study all presented with this latter feature in their spontaneous production. The issues considered in this section concern, first, the relationship between omissions and substitutions of function words and, second, the extent and type of variation in the omission and substitution of function words in our sample of agrammatic speakers. The objective is to explore the patterns and range of variation in the omission and substitution of freestanding grammatical morphemes when we ignore various other aspects of patients' performance such as substitutions of bound grammatical morphemes and omissions of major lexical items. This analysis shows that the observed variation is such that it cannot easily be accounted for by extant models of the putative category of "agrammatism."

The analysis considers the incidence and distribution of omission and substitution errors on freestanding grammatical morphemes as a whole and the patterns of omission and substitution errors observed in each patient for each of five subsets of morphemes—definite and indefinite articles, prepositions, clitic particles, and auxiliary verbs. The results of these analyses are shown in Tables 5–8.

Table 5 presents the percentage omission and substitution rates of freestanding grammatical morphemes for each patient and a normal control group. It is clear from these data that patients vary considerably in the extent to which they omit function words in sentence production. Some patients only omitted about 10% while others omitted up to 50% of function words in obligatory contexts. However, these numbers are quite uninformative on their own since they may reflect no more than the severity of deficit in patients with the same underlying disorder. A more informative analysis for our purposes concerns the comparison of omission and substitution rates. As is the case with omissions, substitution errors on freestanding grammatical morphemes show a wide range of variation (compare T.F. (0.6%) and G.G. (0.8%) with F.S. (19.8%) and L.S. (14.8%)). However, there appears to be little relationship between the incidence of omissions and substitutions of function words in the same patient. Patients T.F., G.F., G.G., and F.A. demonstrate a very high omission
TABLE 5
INCIDENCE AND DISTRIBUTION OF OMISSION AND SUBSTITUTION ERRORS ON FREESTANDING GRAMMATICAL MORPHEMES CONSIDERED AS A WHOLE AND CUMULATIVE ERROR RATE ON THE SAME ITEMS

<table>
<thead>
<tr>
<th>Subject</th>
<th>% Omission errors</th>
<th>% Substitution errors</th>
<th>% Overall errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.A.</td>
<td>25.0</td>
<td>7.7</td>
<td>32.7</td>
</tr>
<tr>
<td>F.A.</td>
<td>19.2</td>
<td>1.7</td>
<td>20.9</td>
</tr>
<tr>
<td>F.B.</td>
<td>9.7</td>
<td>2.8</td>
<td>12.5</td>
</tr>
<tr>
<td>C.D.</td>
<td>7.2</td>
<td>5.2</td>
<td>12.4</td>
</tr>
<tr>
<td>F.D.</td>
<td>21.4</td>
<td>7.5</td>
<td>28.9</td>
</tr>
<tr>
<td>C.D.A.</td>
<td>24.3</td>
<td>7.4</td>
<td>31.7</td>
</tr>
<tr>
<td>G.D.C.</td>
<td>40.4</td>
<td>7.4</td>
<td>47.8</td>
</tr>
<tr>
<td>E.D.U.</td>
<td>7.4</td>
<td>8.4</td>
<td>15.8</td>
</tr>
<tr>
<td>G.F.</td>
<td>49.6</td>
<td>2.4</td>
<td>52.0</td>
</tr>
<tr>
<td>T.F.</td>
<td>50.0</td>
<td>0.6</td>
<td>50.6</td>
</tr>
<tr>
<td>F.G.</td>
<td>9.9</td>
<td>4.3</td>
<td>14.2</td>
</tr>
<tr>
<td>G.G.</td>
<td>24.6</td>
<td>0.8</td>
<td>25.4</td>
</tr>
<tr>
<td>M.L.</td>
<td>5.3</td>
<td>3.8</td>
<td>9.1</td>
</tr>
<tr>
<td>A.M.</td>
<td>32.7</td>
<td>4.7</td>
<td>37.4</td>
</tr>
<tr>
<td>M.M.</td>
<td>19.8</td>
<td>4.3</td>
<td>24.1</td>
</tr>
<tr>
<td>B.P.</td>
<td>28.6</td>
<td>10.5</td>
<td>39.1</td>
</tr>
<tr>
<td>D.S.</td>
<td>12.7</td>
<td>3.2</td>
<td>15.9</td>
</tr>
<tr>
<td>F.S.</td>
<td>22.3</td>
<td>19.8</td>
<td>42.1</td>
</tr>
<tr>
<td>L.S.</td>
<td>19.3</td>
<td>14.8</td>
<td>34.1</td>
</tr>
<tr>
<td>M.U.</td>
<td>20.0</td>
<td>9.5</td>
<td>29.5</td>
</tr>
<tr>
<td>Norm (range)</td>
<td>0–1.6%</td>
<td>0–1.3%</td>
<td>0–2.9%</td>
</tr>
<tr>
<td>Norm (avg.)</td>
<td>0.27%</td>
<td>0.26%</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

rate and a very low substitution rate (T.F.: 50% vs. 0.6%; G.F.: 49.6% vs. 2.4%; G.G.: 24.6% vs. 0.8%; F.A.: 19.2% vs. 1.7%), whereas subjects F.S., E.D.U., L.S., and C.D. show a comparable percentage incidence of omissions and substitutions (F.S.: 22.3% vs. 19.8%; E.D.U.: 7.4% vs. 8.4%; L.S.: 19.3% vs. 14.8%; C.D.: 7.2% vs. 5.2%). Furthermore, no relationship exists between absolute levels of omission and substitution rates across patients; thus, for example, patients F.S. and G.G. make approximately the same percentage of omission errors (22.3 and 24.6%), yet F.S. makes a very high proportion of substitution errors (19.8% of the freestanding grammatical morphemes are substituted), whereas G.G. makes essentially no errors of this type (0.8%). The clearest dissociation of the two types of errors is observed in patients T.F. and G.F., who display the highest omission rates in our sample (50 and 49.6%, respectively) but make virtually no substitution errors (0.6 and 2.4%, respectively). The significance of these results is not immediately apparent. Traditionally, substitution errors of function words have been considered to
reflect a different underlying deficit from that which results in the omission of these words. Although this intuitive distinction may prove to be correct, it does not help us in deciding whether patients who in addition to omission errors also produce substitution errors should be considered agrammatic. We will take up this issue under the Discussion.

Distribution of errors across different function words: Table 6 shows the incidence of errors (combined omissions and substitutions) in the production of the five types of function words included in our analysis—prepositions, definite and indefinite articles, clitics, and auxiliary verbs. Once again we note striking variations in error patterns: No consistent rank of difficulty can be observed, and different subjects show different error patterns. The clearest instances of such lack of consistent patterns are patients C.D.A.: errors on 61.5% of the clitic particles, but on only 6.2% of the auxiliary verbs; E.D.U.: errors on 52.6% of the auxiliary verbs but on only 5.3% of the indefinite articles; T.F.: errors on 100% of the clitic particles but on 20.3% of the prepositions; F.G.: errors on 50% of the auxiliary verbs but on only 7.9% of the definite and 7.1% of the indefinite articles; G.G.: errors on 34.6% of the definite and 37.5% of the indefinite articles, but no errors on auxiliaries; M.M.: errors on 80% of the clitic particles, but on only 11% of the definite articles, and error-free performance on indefinite articles; M.U.: 44.4% errors on clitics and no errors on auxiliaries and indefinite articles. From these data it is clear that no consistent pattern of impairment in the production of freestanding grammatical morphemes is found in our patient series. It may turn out that there is a principled account that could explain the observed variation. However, if nothing else, it should be abundantly clear that the observed variation is not "largely explainable" by current accounts of "agrammatism"—principles such as the sonorance hierarchy, morphological paradigms, or "processing" considerations cannot account for the varied forms of relative error patterns of function word errors (omissions and substitutions).

It might be objected that the observed variations in error patterns only result because of our conflation of omissions and substitutions of function words. But, this is not the case. Equally diverse patterns of function word errors emerge when we consider separately omissions and substitutions of function words. Table 7 presents separately the relative omission and substitution rates of the various freestanding grammatical morphemes observed in our patient sample. For example, A.A. makes substitution and omission errors with definite articles (10.7 and 14.3%, respectively), otherwise she makes only omission errors with prepositions (66.7%) and no errors at all with indefinite articles and clitics (the number of obligatory contexts for auxiliary verbs is too small to draw any conclusions on A.A.'s behavior on these items). Patient G.D.C. makes substitution errors only with articles—with other function words his errors consist only of
<table>
<thead>
<tr>
<th>Subject</th>
<th>N</th>
<th>% Errors</th>
<th>N</th>
<th>% Errors</th>
<th>N</th>
<th>% Errors</th>
<th>N</th>
<th>% Errors</th>
<th>N</th>
<th>% Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepositions</td>
<td>Definite articles</td>
<td>Indefinite articles</td>
<td>Clitics</td>
<td>Auxiliaries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.A.</td>
<td>9</td>
<td>66.7</td>
<td>28</td>
<td>25.0</td>
<td>6</td>
<td>—</td>
<td>5</td>
<td>—</td>
<td>4</td>
<td>100.0</td>
</tr>
<tr>
<td>F.A.</td>
<td>32</td>
<td>34.3</td>
<td>48</td>
<td>8.3</td>
<td>6</td>
<td>—</td>
<td>15</td>
<td>46.7</td>
<td>9</td>
<td>33.3</td>
</tr>
<tr>
<td>F.B.</td>
<td>65</td>
<td>15.3</td>
<td>57</td>
<td>3.5</td>
<td>2</td>
<td>—</td>
<td>11</td>
<td>18.2</td>
<td>13</td>
<td>30.8</td>
</tr>
<tr>
<td>C.D.</td>
<td>149</td>
<td>10.8</td>
<td>136</td>
<td>7.5</td>
<td>24</td>
<td>25.0</td>
<td>114</td>
<td>16.7</td>
<td>23</td>
<td>17.4</td>
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<tr>
<td>F.D.</td>
<td>148</td>
<td>33.1</td>
<td>92</td>
<td>26.1</td>
<td>21</td>
<td>42.8</td>
<td>62</td>
<td>24.2</td>
<td>44</td>
<td>29.6</td>
</tr>
<tr>
<td>C.D.A.</td>
<td>85</td>
<td>40.0</td>
<td>121</td>
<td>29.8</td>
<td>4</td>
<td>25.0</td>
<td>13</td>
<td>61.5</td>
<td>32</td>
<td>6.2</td>
</tr>
<tr>
<td>G.D.C.</td>
<td>18</td>
<td>83.3</td>
<td>56</td>
<td>33.9</td>
<td>9</td>
<td>55.6</td>
<td>9</td>
<td>44.4</td>
<td>2</td>
<td>100.0</td>
</tr>
<tr>
<td>E.D.U.</td>
<td>110</td>
<td>10.9</td>
<td>109</td>
<td>12.8</td>
<td>19</td>
<td>5.3</td>
<td>40</td>
<td>25.0</td>
<td>19</td>
<td>52.6</td>
</tr>
<tr>
<td>G.F.</td>
<td>52</td>
<td>44.3</td>
<td>41</td>
<td>58.5</td>
<td>3</td>
<td>33.3</td>
<td>11</td>
<td>36.4</td>
<td>18</td>
<td>72.2</td>
</tr>
<tr>
<td>T.F.</td>
<td>59</td>
<td>20.3</td>
<td>50</td>
<td>64.0</td>
<td>9</td>
<td>33.3</td>
<td>15</td>
<td>100.0</td>
<td>30</td>
<td>73.3</td>
</tr>
<tr>
<td>F.G.</td>
<td>60</td>
<td>16.6</td>
<td>51</td>
<td>7.9</td>
<td>14</td>
<td>7.1</td>
<td>28</td>
<td>14.3</td>
<td>8</td>
<td>50.0</td>
</tr>
<tr>
<td>G.G.</td>
<td>41</td>
<td>18.5</td>
<td>52</td>
<td>34.6</td>
<td>8</td>
<td>37.5</td>
<td>13</td>
<td>15.4</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>M.L.</td>
<td>37</td>
<td>5.4</td>
<td>33</td>
<td>18.2</td>
<td>11</td>
<td>—</td>
<td>32</td>
<td>9.4</td>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>A.M.</td>
<td>36</td>
<td>38.9</td>
<td>44</td>
<td>56.8</td>
<td>6</td>
<td>33.3</td>
<td>36</td>
<td>16.6</td>
<td>28</td>
<td>32.2</td>
</tr>
<tr>
<td>M.M.</td>
<td>58</td>
<td>29.3</td>
<td>100</td>
<td>11.0</td>
<td>5</td>
<td>—</td>
<td>15</td>
<td>80.0</td>
<td>9</td>
<td>55.5</td>
</tr>
<tr>
<td>B.P.</td>
<td>30</td>
<td>53.3</td>
<td>58</td>
<td>27.5</td>
<td>2</td>
<td>—</td>
<td>7</td>
<td>57.2</td>
<td>8</td>
<td>62.5</td>
</tr>
<tr>
<td>C.S.</td>
<td>6</td>
<td>—</td>
<td>33</td>
<td>15.4</td>
<td>2</td>
<td>—</td>
<td>16</td>
<td>25.0</td>
<td>6</td>
<td>16.7</td>
</tr>
<tr>
<td>F.S.</td>
<td>75</td>
<td>54.7</td>
<td>98</td>
<td>35.7</td>
<td>40</td>
<td>25.0</td>
<td>24</td>
<td>50.0</td>
<td>5</td>
<td>80.0</td>
</tr>
<tr>
<td>L.S.</td>
<td>28</td>
<td>21.4</td>
<td>31</td>
<td>38.7</td>
<td>6</td>
<td>50.0</td>
<td>15</td>
<td>33.3</td>
<td>8</td>
<td>50.0</td>
</tr>
<tr>
<td>M.U.</td>
<td>30</td>
<td>40.0</td>
<td>49</td>
<td>16.3</td>
<td>6</td>
<td>—</td>
<td>18</td>
<td>44.4</td>
<td>2</td>
<td>—</td>
</tr>
</tbody>
</table>

*N, number of obligatory contexts.*
TABLE 7
INCIDENCE AND DISTRIBUTION OF OMISSION AND SUBSTITUTION ERRORS IN EACH CATEGORY OF FREESTANDING GRAMMATICAL MARKERS

<table>
<thead>
<tr>
<th>Subject</th>
<th>Prepositions % Om.</th>
<th>Prepositions % Sub.</th>
<th>Definite articles % Om.</th>
<th>Definite articles % Sub.</th>
<th>Indefinite articles % Om.</th>
<th>Indefinite articles % Sub.</th>
<th>Clitics % Om.</th>
<th>Clitics % Sub.</th>
<th>Auxiliaries % Om.</th>
<th>Auxiliaries % Sub.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.A.</td>
<td>66.7</td>
<td>-</td>
<td>14.3</td>
<td>10.7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>75.0</td>
<td>25.0</td>
</tr>
<tr>
<td>F.A.</td>
<td>28.1</td>
<td>6.2</td>
<td>8.3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>33.3</td>
<td>-</td>
</tr>
<tr>
<td>F.B.</td>
<td>13.8</td>
<td>1.5</td>
<td>3.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>23.1</td>
<td>7.7</td>
</tr>
<tr>
<td>C.D.</td>
<td>7.4</td>
<td>3.4</td>
<td>6.0</td>
<td>1.5</td>
<td>12.3</td>
<td>12.5</td>
<td>-</td>
<td>-</td>
<td>8.7</td>
<td>8.7</td>
</tr>
<tr>
<td>F.D.</td>
<td>22.3</td>
<td>10.8</td>
<td>20.7</td>
<td>5.4</td>
<td>33.3</td>
<td>9.5</td>
<td>7.0</td>
<td>9.7</td>
<td>3.1</td>
<td>3.1</td>
</tr>
<tr>
<td>C.D.A.</td>
<td>27.1</td>
<td>12.9</td>
<td>24.8</td>
<td>5.0</td>
<td>25.0</td>
<td>-</td>
<td>53.8</td>
<td>7.7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G.D.C.</td>
<td>83.3</td>
<td>-</td>
<td>25.0</td>
<td>8.9</td>
<td>33.3</td>
<td>22.2</td>
<td>44.4</td>
<td>-</td>
<td>100.0</td>
<td>-</td>
</tr>
<tr>
<td>E.D.U.</td>
<td>7.3</td>
<td>3.6</td>
<td>5.5</td>
<td>7.3</td>
<td>-</td>
<td>5.3</td>
<td>10.0</td>
<td>15.0</td>
<td>21.0</td>
<td>31.6</td>
</tr>
<tr>
<td>G.F.</td>
<td>38.5</td>
<td>5.8</td>
<td>58.5</td>
<td>-</td>
<td>33.3</td>
<td>-</td>
<td>36.4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>T.F.</td>
<td>18.6</td>
<td>1.7</td>
<td>64.0</td>
<td>-</td>
<td>33.3</td>
<td>-</td>
<td>100.0</td>
<td>-</td>
<td>63.3</td>
<td>10.0</td>
</tr>
<tr>
<td>F.G.</td>
<td>8.3</td>
<td>8.3</td>
<td>5.9</td>
<td>2.0</td>
<td>-</td>
<td>7.1</td>
<td>14.3</td>
<td>-</td>
<td>50.0</td>
<td>-</td>
</tr>
<tr>
<td>G.G.</td>
<td>18.5</td>
<td>-</td>
<td>32.7</td>
<td>1.9</td>
<td>37.5</td>
<td>-</td>
<td>15.4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>M.L.</td>
<td>2.7</td>
<td>2.7</td>
<td>15.2</td>
<td>3.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>9.4</td>
<td>5.0</td>
<td>-</td>
</tr>
<tr>
<td>A.M.</td>
<td>38.9</td>
<td>-</td>
<td>50.0</td>
<td>6.8</td>
<td>33.3</td>
<td>-</td>
<td>8.3</td>
<td>8.3</td>
<td>28.6</td>
<td>3.6</td>
</tr>
<tr>
<td>M.M.</td>
<td>27.6</td>
<td>1.7</td>
<td>6.0</td>
<td>5.0</td>
<td>-</td>
<td>-</td>
<td>80.0</td>
<td>-</td>
<td>33.3</td>
<td>22.2</td>
</tr>
<tr>
<td>B.P.</td>
<td>43.3</td>
<td>10.0</td>
<td>24.1</td>
<td>3.4</td>
<td>-</td>
<td>-</td>
<td>14.3</td>
<td>42.9</td>
<td>25.0</td>
<td>37.5</td>
</tr>
<tr>
<td>C.S.</td>
<td>-</td>
<td>-</td>
<td>12.1</td>
<td>3.3</td>
<td>-</td>
<td>-</td>
<td>18.7</td>
<td>6.2</td>
<td>16.7</td>
<td>-</td>
</tr>
<tr>
<td>F.S.</td>
<td>30.7</td>
<td>24.0</td>
<td>11.2</td>
<td>24.5</td>
<td>10.0</td>
<td>15.0</td>
<td>50.0</td>
<td>-</td>
<td>80.0</td>
<td>-</td>
</tr>
<tr>
<td>L.S.</td>
<td>14.3</td>
<td>7.1</td>
<td>22.6</td>
<td>16.1</td>
<td>-</td>
<td>50.0</td>
<td>20.0</td>
<td>13.3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>M.U.</td>
<td>20.0</td>
<td>20.0</td>
<td>14.3</td>
<td>2.0</td>
<td>-</td>
<td>-</td>
<td>33.3</td>
<td>11.1</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
omissions. Patient F.S. produces a high number of omission and substitution errors on prepositions and articles (17.8 and 22.5%, respectively), but all his errors on clitic particles and auxiliary verbs take the form of omissions (55.2%).

To sum up this section, our analyses demonstrate that there is extreme variation in the rate of omission of freestanding grammatical markers and that omissions are not distributed homogeneously across subsets of grammatical morphemes. A surprisingly high incidence of substitution errors was found in most (but by no means in all) patients in our sample; once again, however, no consistent relationship existed between omission and substitution rates, and substitution rates differed across subsets of freestanding grammatical morphemes. These results cannot be accommodated within extant characterizations of the mechanisms underlying the processing of freestanding grammatical morphemes. Indeed, it is not even clear what data patterns should be taken as the basis for an explanatory effort—it does not appear possible to specify a level of abstraction from these data (short of a useless definitional approach—see Badecker & Caramazza, 1985) which would serve as the basis for making claims about the nature of the underlying disorder in these patients we have classified as agrammatic.

4. Errors on Bound Grammatical Markers and Their Relationships to Errors on Freestanding Grammatical Markers

In the introduction we defined agrammatism as a disorder of sentence production characterized by the omission of freestanding grammatical morphemes and the omission or substitution of bound grammatical morphemes. The need for including substitution of bound grammatical morphemes in our definition is dictated by specific properties of Italian which unlike English do not permit the mere omission of an inflection without resulting in a nonword. It is important, therefore, to consider the pattern of substitutions of inflections in our patients.

The relative incidence of errors in the production of bound grammatical morphemes for our patients is reported in Table 8. Before considering these results further it is worth stressing right at the outset that not one of our patients made errors which could be interpreted as omissions of a bound grammatical morpheme. All the errors in the production of these items observed in our corpora (n = 434) can be unambiguously interpreted as substitution errors.

The comparison between the errors made by our subjects in the production of freestanding vs. bound grammatical morphemes can be made by considering different indices of impairment.

A first comparison was made by contrasting the combined incidence of substitution and omission errors on freestanding grammatical morphemes with the incidence of bound grammatical morpheme substitutions. Although
### TABLE 8

Incidence and Distribution of Omission and Substitution Error on Freestanding Grammatical Morphemes Considered as a Whole and Cumulative Error Rate on the Same Items (As in Table 5) and Incidence and Distribution of Substitution Errors on Bound Grammatical Markers

<table>
<thead>
<tr>
<th>Subject</th>
<th>Freestanding grammatical morphemes</th>
<th>Bound grammatical morphemes:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall errors (%)</td>
<td>Omission errors (%)</td>
</tr>
<tr>
<td>A.A.</td>
<td>32.7</td>
<td>25.0</td>
</tr>
<tr>
<td>F.A.</td>
<td>20.9</td>
<td>19.2</td>
</tr>
<tr>
<td>F.B.</td>
<td>12.5</td>
<td>9.7</td>
</tr>
<tr>
<td>C.D.</td>
<td>12.4</td>
<td>7.2</td>
</tr>
<tr>
<td>F.D.</td>
<td>28.9</td>
<td>21.4</td>
</tr>
<tr>
<td>C.D.A.</td>
<td>31.7</td>
<td>24.3</td>
</tr>
<tr>
<td>G.D.C.</td>
<td>47.8</td>
<td>40.4</td>
</tr>
<tr>
<td>E.D.U.</td>
<td>15.8</td>
<td>7.4</td>
</tr>
<tr>
<td>G.F.</td>
<td>52.0</td>
<td>49.6</td>
</tr>
<tr>
<td>T.F.</td>
<td>50.6</td>
<td>50.0</td>
</tr>
<tr>
<td>F.G.</td>
<td>14.2</td>
<td>9.9</td>
</tr>
<tr>
<td>G.G.</td>
<td>25.4</td>
<td>24.6</td>
</tr>
<tr>
<td>M.L.</td>
<td>9.1</td>
<td>5.3</td>
</tr>
<tr>
<td>A.M.</td>
<td>37.4</td>
<td>32.7</td>
</tr>
<tr>
<td>M.M.</td>
<td>24.1</td>
<td>19.8</td>
</tr>
<tr>
<td>B.P.</td>
<td>39.1</td>
<td>28.6</td>
</tr>
<tr>
<td>C.S.</td>
<td>15.9</td>
<td>12.7</td>
</tr>
<tr>
<td>F.S.</td>
<td>42.1</td>
<td>22.3</td>
</tr>
<tr>
<td>L.S.</td>
<td>34.1</td>
<td>19.3</td>
</tr>
<tr>
<td>M.U.</td>
<td>29.5</td>
<td>20.0</td>
</tr>
<tr>
<td>Norm (range)</td>
<td>0–2.9</td>
<td>0–1.6</td>
</tr>
<tr>
<td>Norm (avg.)</td>
<td>0.5</td>
<td>0.27</td>
</tr>
</tbody>
</table>

There appears to be a correlation between error rates on the two types of morphemes ($r = .84, p < .01$) there are also some interesting deviations from this pattern. Thus, for example, patients C.D. and A.M. display roughly the same incidence of substitutions of bound grammatical morphemes (5.8 and 6.5%, respectively); however, C.D. makes errors on only 12.4% of the freestanding grammatical morphemes, whereas A.M. produces incorrectly 37.4% of these items. Conversely, patients F.G. and E.D.U. make approximately the same percentage of errors on freestanding grammatical morphemes (14.2 and 15.8%, respectively), yet F.G. substitutes only 0.8% of the bound grammatical morphemes while E.D.U. displays a much higher rate of substitution of these items (8.6%).

Essentially the same results are obtained if the rate of omission of freestanding grammatical morphemes is compared to the rate of substitution...
of bound grammatical morphemes: A general correlation exists \((r = .77, p < .01)\) but clear exceptions are also present. The same contrast as in the previous paragraph is observed if patients C.D. and A.M. are considered again: C.D. omits only 7.2% to A.M.'s 32.7% of the freestanding grammatical morphemes. The opposite contrast is demonstrated by patients C.D.A. and G.G., as opposed to patient F.S. These three patients omit approximately the same percentage of freestanding grammatical morphemes (24.3, 24.6, and 22.3%, respectively), but C.D.A. and G.G. demonstrate a rather low substitution rate on bound grammatical morphemes (5.7 and 4.7%, respectively) compared to F.S.'s 20.4% incorrect production.

We also compared the rate of substitution of bound grammatical morphemes with the rate of substitution of freestanding grammatical morphemes. In this case too, obvious differences in performance are observed across patients \((r = .25, \text{n.s.})\). Cases G.G. and T.F. show the same, negligible incidence of freestanding grammatical morpheme substitution (0.8 and 0.6%, respectively), and yet G.G. substitutes 4.7% bound grammatical morphemes to T.F.'s 21.1%. Similarly, F.B. and G.F. produce a comparable number of substitutions of freestanding grammatical morphemes (2.8 and 2.4%, respectively), and a very different number of substitutions of bound grammatical morphemes (1.7 and 24.2%, respectively). Conversely, T.F. and F.S. substitute bound grammatical morphemes at approximately the same rate (21.1% vs. 20.4%, respectively), yet T.F. almost never substitutes freestanding grammatical morphemes, whereas F.S. makes very frequent substitution errors (0.6% vs. 19.8%). In our sample there are no instances of patients who make substitution errors on freestanding, but not on bound, grammatical morphemes.

The results of our analyses of the relationship between errors on freestanding and on bound grammatical morphemes can now be briefly summarized. In all the comparisons we noted a relationship between errors on freestanding and bound grammatical morphemes; however, clear-cut deviations from the general pattern were observed. In each comparison we carried out we found patients who showed comparable impairment on one set of items, but very different impairment in the production of items from the other set. Only when the comparison was restricted to substitution errors did we find that in our sample there are no patients who display a high incidence of substitutions of freestanding grammatical morphemes and a low (or very low) incidence of bound grammatical morpheme substitutions. One conclusion that is possible from these results is that the difficulties in the production of freestanding and of bound grammatical morphemes in our patient sample are largely independent—damage to separate mechanisms is responsible for the two types of grammatical morphemes.
5. Analysis of the Violations of Agreement Relations

Thus far, we have considered grammatical morphemes in isolation. However, both freestanding and bound grammatical morphemes enter in agreement relations. Thus, for example, articles are involved in nominal agreement; auxiliary verbs are part of complex verbal relations; and inflections, be they nominal, adjectival, or verbal, all enter in agreement relations. For this reason, the scope of our analysis was further broadened. The performance obtained by our group of agrammatic speakers on all grammatical morphemes was evaluated by considering the following agreement relations: det–noun, noun–adjective, and subject–verb.

Before we present our data, some clarifications concerning the scoring procedure should be made. In the evaluation of det–noun agreement, instances where the article was omitted were not counted. The incidence of det–noun agreement violations was evaluated on the basis of those instances where an article was produced (correctly or incorrectly). Some NPs containing a det–noun combination, which had been excluded from previous analysis because they had been produced in the absence of a recoverable grammatical structure, were included in this count.

The incidence of noun–adjective agreement violations was evaluated using as a database all sequences that included inflected adjectives. The incidence of subject–verb agreement violations was calculated on the basis of all the instances where the subject of the sentence, whether present or (as it is very often the case in Italian) absent from the surface structure, could be unambiguously identified. Agreement errors were scored both if they appeared in the production of lexical verbs and if they occurred in the production of the auxiliary verb (which, in Italian, is inflected just like any other verb).

The results of this analysis are shown in Table 9. Inspection of Table 9 reveals the existence of two distinct patterns of impairment, as well as intermediate patterns between the two extremes. The first pattern is observed most clearly in patients F.S. and L.S. but is also present in patients F.A., G.D.C., B.P., and M.U. In these patients, all types of agreement are impaired. Not surprisingly, subject–verb agreement is usually the most impaired, probably due to the fact that in Italian the inflectional paradigm of verbs is much more complex than that of nouns and adjectives (approximately 40 inflections for verbs, as opposed to 2, or exceptionally 4, for nouns and 4, or less frequently 2, for adjectives). The other relevant pattern is observed in patient T.F. and consists of the complete sparing of nominal and adjectival agreement, in the presence of a very severe deficit of verbal agreement—in fact, T.F. is the patient in our sample who shows the most severe impairment of verb agreement. The same pattern of impairment, although in a slightly less pure form, is observed in patients G.F. and G.G. Patient G.F. makes only 1 error
TABLE 9
INCIDENCE AND DISTRIBUTION OF VIOLATIONS OF DETERMINER–NOUN, NOUN–ADJECTIVE AND
SUBJECT–VERB AGREEMENT

<table>
<thead>
<tr>
<th>Subject</th>
<th>Determiner–Noun</th>
<th>Noun–Adjective</th>
<th>Subject–Verb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>% Violation</td>
<td>N</td>
</tr>
<tr>
<td>A.A.</td>
<td>25</td>
<td>8.0</td>
<td>8</td>
</tr>
<tr>
<td>F.A.</td>
<td>71</td>
<td>5.6</td>
<td>45</td>
</tr>
<tr>
<td>F.B.</td>
<td>63</td>
<td>—</td>
<td>9</td>
</tr>
<tr>
<td>C.D.</td>
<td>127</td>
<td>0.8</td>
<td>57</td>
</tr>
<tr>
<td>F.D.</td>
<td>67</td>
<td>1.5</td>
<td>78</td>
</tr>
<tr>
<td>C.D.A.</td>
<td>95</td>
<td>4.2</td>
<td>38</td>
</tr>
<tr>
<td>G.D.C.</td>
<td>70</td>
<td>5.7</td>
<td>9</td>
</tr>
<tr>
<td>E.D.U.</td>
<td>99</td>
<td>2.0</td>
<td>32</td>
</tr>
<tr>
<td>G.F.</td>
<td>18</td>
<td>5.6</td>
<td>28</td>
</tr>
<tr>
<td>T.F.</td>
<td>18</td>
<td>—</td>
<td>56</td>
</tr>
<tr>
<td>F.G.</td>
<td>73</td>
<td>1.4</td>
<td>32</td>
</tr>
<tr>
<td>G.G.</td>
<td>65</td>
<td>—</td>
<td>26</td>
</tr>
<tr>
<td>M.L.</td>
<td>34</td>
<td>2.9</td>
<td>25</td>
</tr>
<tr>
<td>A.M.</td>
<td>18</td>
<td>11.1</td>
<td>20</td>
</tr>
<tr>
<td>M.M.</td>
<td>110</td>
<td>4.5</td>
<td>26</td>
</tr>
<tr>
<td>B.P.</td>
<td>43</td>
<td>9.3</td>
<td>26</td>
</tr>
<tr>
<td>C.S.</td>
<td>20</td>
<td>—</td>
<td>10</td>
</tr>
<tr>
<td>F.S.</td>
<td>138</td>
<td>14.5</td>
<td>50</td>
</tr>
<tr>
<td>L.S.</td>
<td>32</td>
<td>12.5</td>
<td>7</td>
</tr>
<tr>
<td>M.U.</td>
<td>61</td>
<td>3.3</td>
<td>12</td>
</tr>
</tbody>
</table>

In 18 instances of det–noun agreement (5.6%), no errors of noun–adjective agreement, and 55 violations of subject–verb agreement out of 100 instances (55%). Patient G.G. makes no errors of det–noun agreement, only 1 error in 26 instances of noun–adjective agreement (3.8%), and 10 violations out of 54 instances of subject–verb agreement (18.5%).

A more detailed analysis of error patterns in agreement relations was undertaken for verbal agreements. Verb agreement errors were divided in two broad categories: those which resulted in the production of the citation form of the verb, and those which resulted in the production of other incorrect verb forms. For this analysis we considered both the infinitive and the past participle as citation forms. Table 10 reports the results of this analysis. The results unequivocally show that three patients (T.F., G.F., and G.G.) can be confidently set apart from the other subjects in our sample. If we consider only those patients who produced at least 10 instances of verb agreement errors, we find that the citation form of the verb constitutes the overwhelming majority of the errors only in the case of patients T.F. (95.4%), G.F. (96.4%), and G.G. (100%). In the other patients of our group, the percentage incidence of this error type...
TABLE 10
SUBJECT-VERB AGREEMENT ERRORS: DISTRIBUTION OF ERRORS CONSISTING OF THE PRODUCTION OF CITATION FORMS VS. OTHER INCORRECTLY INFLECTED FORMS

<table>
<thead>
<tr>
<th>Subject</th>
<th>Number of violations</th>
<th>Citation form</th>
<th>Other incorrect verb forms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>A.A.</td>
<td>10</td>
<td>6</td>
<td>(60.0)</td>
</tr>
<tr>
<td>F.A.</td>
<td>24</td>
<td>7</td>
<td>(29.2)</td>
</tr>
<tr>
<td>F.B.</td>
<td>3</td>
<td>2</td>
<td>(66.7)</td>
</tr>
<tr>
<td>C.D.</td>
<td>12</td>
<td>2</td>
<td>(16.7)</td>
</tr>
<tr>
<td>F.D.</td>
<td>23</td>
<td>15</td>
<td>(65.2)</td>
</tr>
<tr>
<td>C.D.A.</td>
<td>16</td>
<td>2</td>
<td>(12.5)</td>
</tr>
<tr>
<td>G.D.C.</td>
<td>20</td>
<td>6</td>
<td>(30.0)</td>
</tr>
<tr>
<td>F.D.U.</td>
<td>28</td>
<td>5</td>
<td>(17.9)</td>
</tr>
<tr>
<td>G.F.</td>
<td>55</td>
<td>53</td>
<td>(96.4)</td>
</tr>
<tr>
<td>T.F.</td>
<td>65</td>
<td>62</td>
<td>(95.4)</td>
</tr>
<tr>
<td>F.G.</td>
<td>5</td>
<td>3</td>
<td>(60.0)</td>
</tr>
<tr>
<td>G.G.</td>
<td>10</td>
<td>10</td>
<td>(100.0)</td>
</tr>
<tr>
<td>M.L.</td>
<td>2</td>
<td>1</td>
<td>(50.0)</td>
</tr>
<tr>
<td>A.M.</td>
<td>13</td>
<td>7</td>
<td>(53.8)</td>
</tr>
<tr>
<td>M.M.</td>
<td>9</td>
<td>2</td>
<td>(22.2)</td>
</tr>
<tr>
<td>B.P.</td>
<td>24</td>
<td>11</td>
<td>(45.8)</td>
</tr>
<tr>
<td>C.S.</td>
<td>3</td>
<td>2</td>
<td>(66.7)</td>
</tr>
<tr>
<td>F.S.</td>
<td>42</td>
<td>23</td>
<td>(54.8)</td>
</tr>
<tr>
<td>L.S.</td>
<td>10</td>
<td>3</td>
<td>(30.0)</td>
</tr>
<tr>
<td>M.U.</td>
<td>8</td>
<td>6</td>
<td>(75.0)</td>
</tr>
</tbody>
</table>

is much lower. By striking contrast to G.G., G.F., and T.F., other subjects in our sample display a very high incidence of incorrectly inflected verb forms which are not citation forms. The highest number of these errors was produced by patients C.D.A. (87.5%), C.D. (83.3%), and E.D.U. (82.1%).

DISCUSSION

A crucial issue in neuropsychology concerns the role of clinically defined aphasic patient categories as a basis for making claims about normal language processing. In previous publications we have argued that it is impossible to draw theoretically meaningful conclusions about language processing from research based on clinically defined patient categories, and that it is impossible to make theoretically meaningful claims about the nature of the language disorder in such patient categories (Badecker & Caramazza, 1985; Caramazza, 1984, 1986; Caramazza & McCloskey, 1988; McCloskey & Caramazza, 1988). Much of the discussion
on this issue has focused on the putative category "agrammatism," although our claim extends to all a priori patient categories (e.g., deep dyslexia, phonological agraphia, transcortical aphasia, and so forth). Despite the many discussions of this issue, it is far from being resolved. A particularly contentious issue concerns the empirical facts that should be considered in any attempted resolution of the problem. Contrasting claims have been made about the empirical facts concerning the clinical category agrammatism. Consequently, the principal objective of this research was to explore the range of variation in the production of grammatical morphemes in clinically classified agrammatic patients. The detailed and extensive database obtained could then serve as the basis for an informed discussion of whether the clinical disorder identified as agrammatism constitutes a cognitively homogeneous category. We consider the results we have reported in this paper as prima facie evidence against extant claims of homogeneity for the category of "agrammatism." The rest of this discussion is devoted to a defense of this conclusion.

Before undertaking a discussion of the reported results we should consider, even if only briefly, the general problem of determining the boundaries of the agrammatic deficit; that is, we should attempt to answer the question: Which features of agrammatic patients' performance should figure in the present analysis? We have chosen to adopt a narrow definition of the disorder. We have considered only that form of agrammatism which is defined as a disorder of sentence production characterized by the omission of freestanding grammatical morphemes and the omission or substitution of bound grammatical morphemes. We have ignored other putative features of this disorder such as "asyntactic" comprehension and word order processing difficulties. The inclusion of the latter performance features would only have complicated our discussion and, in any case, it is well established that these symptoms dissociate from difficulties in the production of grammatical morphemes (Caramazza & Hillis, in press; Kolk, van Grunsven, & Kuper, 1985; Miceli et al., 1983; Nespoulous et al., 1988; see also Caramazza & Berndt, 1985, for review). The advantage of restricting the focus of our investigation to difficulties in the production of grammatical morphemes is that this symptom (or symptom complex) is unarguably the central feature, if not the only relevant one on all accounts, of agrammatism.

Even with this restriction in the focus of our investigation, there remain nonnegligible problems in determining which aspects of the performance of clinically agrammatic patients should be considered in our analysis. Thus, for example, what status should function-word substitution errors be accorded in the analysis of agrammatic production? Are these errors a reflection of the "agrammatic" disorder? Should substitution errors of inflections be considered on a par with omissions of function words in the analysis of agrammatic patients? Obviously, if we cannot answer
questions of this type it will be futile to pretend that the issue under consideration is an empirical one; not only will we not know who is to be considered as an agrammatic patient but we also will not know what aspects of a patient's performance are theoretically relevant for the analysis of agrammatism. Indeed, a major criticism we have leveled against the use of patient categories in neuropsychological research is that the boundaries of patient categories such as agrammatism are not sufficiently well specified to permit meaningful investigation of the putative categories of deficit (Badecker & Caramazza, 1985; Caramazza, 1988). This latter problem aside, we can take a boot-strap approach to an evaluation of the variation in agrammatic performance by considering, in turn, various definitions of the disorder. Even on such a weak definition of agrammatism (ultimately too weak to be of much theoretical interest), the observed variability in patients' performance undermines any pretension of an empirically based coherence for the category of “agrammatism.”

Variation in the Omission (and Substitution) of Function Words

The central, defining feature of agrammatism is the omission of free-standing grammatical morphemes in spontaneous speech (Caplan, 1986; Goodglass, 1976; Kean, 1977). The analysis of this performance variable in our set of agrammatic patients brings to the fore a series of interesting problems. Let us consider first the pattern of variation among function word omissions. Our analysis of the pattern of omissions of these words failed to reveal a consistent hierarchy of omission rates for five types of function words. Obviously, in such a case it is difficult to maintain the position that there is a principled (unitary) linguistic account which could explain the observed variation (Caplan, 1986). Indeed, the patterns of variation are so large that it is difficult to imagine what could be gained by considering the patients included in the sample as all having a common functional lesion at some level of language processing. Thus, consider the following contrasts (see Table 7). Patients F.A. and A.M. show contrasting patterns of omissions of definite articles and clitics (8% vs. 47% and 50% vs. 8%, respectively); patients C.D.A. and F.B. show contrasting patterns of omissions for clitics and auxiliaries (54% vs. 3% and 0% vs. 23%, respectively); and, patients G.D.C. and T.F. show contrasting patterns of omissions for prepositions and definite articles (83% vs. 25% and 19% vs. 64%, respectively). Of course, one could always appeal to some unspecified, nonlinguistic, “processing” principle which may be assumed to account for the observed variability. However, such a move remains vacuous unless one could articulate the putative “processing” principles that are assumed to be responsible for the variation in question. To our knowledge no interesting proposal has been offered in this regard. And, in any case, this move is a dangerous one, as we will see below.
The picture is further muddied when we consider the relationship between the omission and substitution of freestanding grammatical morphemes. Our results show that there is no consistent relationship between the overall rates of omission and substitution errors for function words. More interestingly, we found contrasting patterns of omission versus substitution error rates for different types of function words. Thus, for example, patient F.S.'s errors for prepositions and articles consist of substitutions and omissions but only of omissions for clitics and auxiliaries; analogously, patient G.D.C.'s errors for prepositions, clitics, and auxiliaries consist entirely of omissions while his errors for articles (definite and indefinite) include nonnegligible proportions of substitutions. Once again we find that the patterns of errors for freestanding grammatical morphemes do vary along apparently inexplicable dimensions at least with respect to linguistic considerations.

Our decision to inject consideration of function-word substitution errors in a discussion of "agrammatism" may be challenged on the grounds that this latter type of error does not form part of the symptom complex of agrammatism. On this account, function-word substitution errors are considered symptomatic of "paragrammatism" and not "agrammatism" and, therefore, should be excluded from analysis of the latter disorder. There are two reasons for considering this counterargument as inadequate for the present discussion. One reason involves the problem of distinguishing between "agrammatism" and "paragrammatism" as distinct, cognitively coherent disorders; the other reason involves the failure to provide a linguistically motivated distinction between omission and substitution of function words.

Suppose that we were to agree that the omission and the substitution of function words could be taken as symptomatic of distinct disorders—"agrammatism" and "paragrammatism," respectively. We would then be confronted with the problem of having to decide which of our patients are agrammatic and which are paragrammatic, or, alternatively, we would have to decide the extent to which each of our patients presents with a mix of agrammatism and paragrammatism. Thus, which of our patients are "true" agrammatics given that they all substitute function words to some extent or other? And, if we take the presence of function-word substitution as symptomatic of "paragrammatism," should we conclude that each of our agrammatic patients also presents with a paragrammatic disorder? Clearly, the empirical facts are such that it does not appear that we can distinguish between the putative categories of "agrammatism" and "paragrammatism," even when we restrict the analysis of speech production impairment to errors with freestanding grammatical morphemes.

There is a more fundamental reason for considering "agrammatism" as a theoretically vacuous category. The most important (defining) feature of agrammatism is taken to be the omission of function words in spon-
taneous speech. But, is there a principled basis for distinguishing between the omission and the substitution of function words? The principal argument given for considering "agrammatism" as a theoretically coherent category, as opposed to merely an empirical category without theoretical motivation, is that this category is defined by appeal to a linguistically motivated distinction—function words can be given an independent linguistic characterization (Caplan, 1986; Kean, 1977). However, even if one were to accept this argument as sufficient motivation for distinguishing patients with a deficit to this class of words from patients with deficits to other linguistic units, the argument would not be sufficient for distinguishing between patients who omit and patients who substitute these words. Thus, the distinction between omission and substitution of function words does not receive its motivation from linguistic theory and, therefore, we do not have a linguistically motivated basis for the putative distinction. If we wish to consider the omission and the substitution of function words as symptomatic of different deficits to the language system, we must appeal not to linguistic theory but to processing principles.

Suppose, then, that we were to assume that the distinction between omission and substitution of freestanding grammatical morphemes reflects different forms of processing deficit to this class of items. This assumption is not implausible, but it is equally unmotivated. Note that the distinction is not made on considerations based on some or other processing theory but on strictly intuitive grounds—it feels like omissions and substitutions should result from different kinds of processing deficits. This intuition may ultimately prove to be correct. However, until a motivated processing account is given for the omission/substitution distinction we must recognize its arbitrary nature and give up any pretense of having a theoretically motivated basis for the category of "agrammatism."

A final comment on the arbitrary nature of the classificatory criteria used for defining agrammatism is in order, especially in light of the analyses reported in this paper. Recall that at an earlier point we noted that the patients in this study differed considerably in terms of their patterns of omissions of five types of function words. The patterns of variation were such that they could not be accounted for on the basis of linguistic principles. In order to maintain that the patients tested should nonetheless all be considered to be agrammatics, one has to assume that the observed differences can be explained by some as yet unspecified processing differences among our patients. In this case, a linguistic criterion—errors in the production of function words—indeed and independently of differences in processing deficits is sufficient to specify category membership. By contrast, the same linguistic criterion is not sufficient for determining category membership when the processing difference involves the contrast between omission and substitution of words (i.e., the difference between "agrammatic" and "paragrammatic" function-word errors).
Clearly, the decision of when a linguistic or processing criterion is sufficient for determining the patient category of agrammatism is totally arbitrary.

Variation in the Substitution of Bound Grammatical Morphemes and Violations of Agreement Relations

Patients' performance in the production of bound grammatical morphemes varied extensively and independently of their performance with freestanding grammatical morphemes. Although we did find a quantitative relationship between omission rate of function words and substitution rate for bound grammatical morphemes, the relationship was not a necessary one since there were a number of clear "dissociations" between error rates for the two classes of grammatical morphemes. That is, we found that some patients presented with striking discrepancies between their rate of substitution errors for bound grammatical morphemes and the rate of function word omissions or substitutions. Furthermore, when we considered the types of substitution errors made by the patients we found as much variability among error types as we had found for omissions of different types of function words. Thus, for example, we found that some patients almost always produced the citation form when they made a verb inflection error, whereas other patients almost always produced the noncitation form when they made a verb error. Equally extreme variations in performance were obtained in the patterns of agreement errors where some patients produced many errors of subject/verb agreement but almost never made errors on within noun phrase agreements—both det/noun and adjective/noun agreements; other patients, by contrast, were as likely to make within-noun-phrase errors as they were to make subject/verb agreement errors.

Once again we find that the "empirical facts" belie all claims of an obvious performance homogeneity among patients who would clinically be classified as agrammatic. The extensive performance variability we found among our agrammatic patients presumably reflects major differences in the deficits to language-specific processes (or related cognitive processes) which underlie each patient's performance. In light of the results and arguments presented here, we find no grounds on which to support the claim that "agrammatism" constitutes a "natural kind" category representing those patients with deficit to a single, well-defined component of the language processing system (or even common and equivalent deficits to multiple components). Instead, we are led once again to conclude that the variability among the putative cases of agrammatism we tested appears to be no less important in determining the precise nature of the functional lesion in thus-classified patients, than the variability that distinguishes among any randomly selected aphasic patients.

In concluding, it is important to stress one final point. The results we have reported belie the claim of significant homogeneity among so-called
agrammatic patients even when the analysis is restricted to just those features of patients' performance—errors in the production of grammatical morphemes—which are considered to be defining of the patient category. The situation is equally bad when we consider variation among other dimensions of language processing; that is, when we consider such features as major-class lexical omissions and phrase length in sentence production, comprehension performance, and grammaticality judgments. For here we find that all of these indices of language processing dissociate from each other and from difficulties in the production of grammatical morphemes (see Caramazza & Berndt, 1985, for review). Thus, in our sample of agrammatic patients we found that some of them have major problems in producing main verbs (rate of omission of the main (lexical) verb in obligatory context: A.A.: 36.7%; C.S.: 26.2%; C.D.A.: 24.8%; B.P.: 21.7%) while others present with little or no difficulty in this area (G.F.: 0%; T.F.: 1.2%; M.L.: 1.9%; E.D.U.: 2%); we found that some patients are able to produce very long sentence constructions (MLU-Lexical: T.F.: 10.5; M.L.: 7.44; C.D.: 7.32; E.D.U.: 6.63) while others have their output reduced to three-word sentences (MLU-Lexical: A.A.: 3.1; G.D.C.: 3.14; C.D.A.: 3.25; A.M.: 3.37); and, as is now well established, sentence comprehension difficulties dissociate from sentence production difficulties (Caramazza & Hillis, in press; Kolk et al., 1985; Miceli et al., 1983; Nespoulous et al., 1988) and the ability to judge the grammaticality of sentences (Linebarger, Schwartz, & Saffran, 1983). These empirical facts can no longer be ignored just for the obstinate protection of a fictional category of dubious theoretical value. There are not only metatheoretical and methodological reasons for doing away with patient categories such as agrammatism, but also empirical demonstrations of the futility of holding on to such categories. Here we have provided one such demonstration.

FOREWORD TO APPENDICES

Since in order to make the case that agrammatism is not a cognitively homogeneous category we must test patients who satisfy accepted criteria for classification as agrammatics, we provide in Appendix 1 patient histories (when available) and in Appendix 2 samples of their spontaneous production.

Key to Appendix 1

Some of the patients have been described in detail elsewhere (patients G.G. and T.F. in Miceli et al. (1983), patients C.D.A. and F.G. in Miceli and Mazzucchi (in press), where they are referred to as Mr. Rossi and Mr. Verdi, respectively, and patient F.S. in Miceli and Caramazza, 1988). For patient F.A., who was tested thanks to the courtesy of Dr. Sergio Carlamagno, only partial information is available. For patients G.D.C., M.M., L.S., and M.U., whose spontaneous speech was made available to us by Professor Anna Mazzucchi, only the details provided in Table 1 are known.

The patients were all submitted to an extensive screening battery for aphasia. The results of only some tasks are described here. The "production" tasks considered concern transcribing (word, nonword, and sentence reading and repetition and writing to dictation) and naming
tasks (of objects and actions, oral and written) are reported. The following "reception" tasks are reported.

(1) Phoneme discrimination and auditory–visual phoneme matching, explored by means of minimal pairs of phonemes (stop consonants) embedded in natural CV syllables;

(2) Single-word comprehension tests: The patient is asked to match a stimulus (presented auditorily or visually by the examiner) to one of two pictures (the correct response and a foil which is related to the stimulus either semantically or phonemically (auditory presentation)/(visual presentation)). Examples: gamba—braccio (leg—arm), martello—mantello (hammer—cape);

(3) Auditorily and visually presented grammaticality judgment tasks;

(4) Reversible sentence comprehension test: The patient is asked to match a stimulus sentence (presented auditorily or visually by the examiner) to one of two pictures (the correct response and a foil). Three types of foils are used, depicting the reversal of thematic roles, a morphologically related alternative, or a semantically related alternative (in the last case the semantically related item portrays either a related action or a related object). Half of the sentences are presented in the active, half in the passive voice. Examples: Il ragazzo insegue la ragazza—La ragazza insegue il ragazzo (The boy is chasing the girl—the girl is chasing the boy); Il ragazzo insegue la ragazza—Il ragazzo insegue le ragazze (The boy is chasing the girl—the boy is chasing the girls); Il ragazzo insegue la ragazza—Il ragazzo insegue la donna (The boy is chasing the girl—the boy is chasing the woman).

Key to Appendix 2

Line 2 of the transcript is a verbatim transcription of the patient's speech. Words with incorrect inflectional endings are underlined, words omitted are in square parentheses.

Line 1 reports the correct target for the words produced incorrectly by the patient.

Line 3 is a verbatim English translation of the patient's output. Omitted words are in square parentheses. Words produced incorrectly in Italian are followed by indications on the correct number (sg., pl.), gender (m., f.), and person (1st, 2nd, 3rd).

Line 4 is an attempt at giving a sense of what the patient's speech would sound like in English.

(In each sample, the narrative from which the sequence was taken is indicated to the right of the patient's name. The following abbreviations are used: A.D.L., activities of daily life; H.O.I., history of illness; C.T., Cookie Theft.)

APPENDIX 1

Patient A.A.

The patient is a right-handed housewife. She has a 5th-grade education, but additionally attended a technical school for 2 years. Prior to her illness, she held a secretarial job. She suffered a ruptured aneurysm in the left middle cerebral artery territory in 1983, at age 33. CT-scan is not available. The patient was seen approximately 1 year postonset. The neurological exam shows a very mild right hemiparesis, with occasional extinction phenomena on the right side of the body. The neuropsychological exam reveals a massive deficit of verbal and visual memory, a severely reduced digit span (span forward: 3), and a mild-to-moderate buccofacial apraxia. Language exam shows a severely nonfluent aphasia, with a mild dysarthria. Transcoding tasks are severely impaired with all materials (nonwords, words, and sentences). Phoneme discrimination is severely impaired. Lexical decisions and single-word comprehension tasks are moderately impaired, more in the visual than in the auditory modality. Naming is poor. Auditory sentence comprehension performance is
severely impaired (the majority of the errors are reversals or of the morphological type). Reading comprehension could not be examined, due to the severity of the reading deficit.

**Patient F.A.**

The patient is a right-handed man, with an 8th-grade education. Prior to his illness, the patient worked as an employee for the national lotteries. A large frontal meningioma was surgically excised in 1975, when F.A. was 58. He was seen 5 years after the onset of symptoms. The neurological exam only showed a mild right-sided hemiparesis. The neuropsychological exam demonstrated a very mild difficulty in learning lists of words, but was otherwise normal. Regarding language, the information is scanty. Spontaneous speech was mildly dysarthric and nonfluent. Occasional phonemic paraphasias were produced, both in spontaneous speech and in naming. Single-word comprehension was in the normal range. Sentence comprehension was mildly impaired.

**Patient F.B.**

This patient is a right-handed woman, a 3rd-year Ph.D. student in Architecture. She suffered from a severe, open head injury in 1982, when she was 21. She was first seen in our Service 3 years later. The neurological exam was negative. CT-scan showed a large hypodense area involving the superficial and deep structures of the left frontal lobe and the cortical areas of the parietal lobe. The left ventricle was enlarged. The neuropsychological exam showed only a mild deficit in a task requiring the ability to learn a list of 15 words. The language exam disclosed a severe aphasic disorder. Spontaneous speech was nonfluent, in the complete absence of dysarthria. Reading and writing to dictation were virtually abolished (for nonwords, words, and sentences); repetition of words and nonwords was relatively less impaired, sentence repetition demonstrated "agrammatic" features. Naming was moderately impaired, and action naming was remarkably more impaired than object naming. Phoneme discrimination and auditory–visual matching of phonemes were impaired. Single-word comprehension tasks were moderately impaired (semantic and phonemic errors with auditory presentation; semantic errors with visual presentation). Grammaticality judgment tasks were impaired. Sentence comprehension tasks were severely impaired (more in the visual than in the auditory modality); most of the errors were either reversals or morphologically related responses.

**Patient C.D.**

The patient is a right-handed man, with a 12th-grade education. He had left school for financial reasons and held an administrative job with the national railway system. At 55, after open heart surgery, he suffered from a cerebrovascular accident (in 1979). He was tested 7 years later. The neurological exam shows a severe right hemiparesis. The CT-scan shows a small lesion, involving the subcortical structures of the left frontal lobe. The neuropsychological exam demonstrates only a moderate reduction of verbal memory, with a normal digit span (span forward: 7). The language exam shows that C.D.’s speech is mildly nonfluent, dysarthric, and dysprosodic, but conveys an essentially normal amount of information. Transcoding tasks are essentially normal. Naming tasks demonstrate occasional anomias and semantic or phonemic paraphasias. Phoneme discrimination, auditory–visual phoneme matching, and single-word comprehension tasks are within normal limits. C.D. demonstrates only minimal difficulties in sentence comprehension (the results are within the lower normal range).

**Patient F.D.**

This patient is a right-handed M.D. with a history of transient ischemic attacks, who had a right-hemisphere stroke in 1978 (at age 57) and a left-hemisphere stroke in 1979.
The speech sample reported here was obtained approximately 1 year later, in 1980. At that time, the neurological exam was negative. A CT-scan showed lesions in the right and in the left temporal lobe, and in the left cingulate gyrus. The neuropsychological exam yielded abnormal results only in phonological memory tasks, and in the tasks where comprehension of an auditory input was required. The language exam showed a fluent aphasia, without articulatory or prosodic deficits. The patient showed features of the "word deafness" syndrome. Naming was characterized by the production of infrequent phonemic paraphasias and of occasional semantic errors. Reading was normal; repetition and writing to dictation were severely impaired. Phoneme discrimination was within normal limits. Single-word and sentence comprehension were normal with visual presentation; auditory comprehension of single words was moderately impaired, and auditory sentence comprehension was severely disturbed.

**Patient C.D.A.**

The patient is a right-handed newspaper writer, with a Ph.D. in Education. In 1981, at age 43, he suffered from a ruptured aneurysm in the left middle cerebral artery territory. The speech sample reported here was obtained 2 years after surgery. The neurological exam demonstrates a mild right facial weakness but is otherwise normal. The CT-scan shows a large lesion, involving the post-Rolandic (parietal and temporal) structures of the left hemisphere, both superficial and deep. The neuropsychological exam is normal, except for a reduced digit span (span forward: 3). The language exam demonstrates a severe, nonfluent aphasia, with a mild prosodic disturbance, but free from dysarthria. Naming tasks reveal anemic difficulties with occasional phonemic errors. Transcoding tasks with items presented in isolation are mildly to moderately impaired, word transcoding being less impaired than nonword transcoding. Most errors result in phonemic/graphemic distortions of the stimulus item. Sentence transcoding tasks demonstrate agrammatic features. Phoneme discrimination is mildly impaired. Single-word comprehension is normal. Sentence comprehension is severely impaired.

**Patient E.D.U.**

This patient is a right-handed woman with a Ph.D. in Humanities, who had a left hemisphere stroke at age 58. She was seen in our Service 1 year postonset. The neurological exam was normal. CT-scan was not available. Since the patient refused to undergo a full neuropsychological and language testing, the available data on higher cortical functions are largely defective. The language exam demonstrated the presence of anomic gaps and of phonemic and (very infrequently) semantic errors. Single-word comprehension was impaired within normal limits, as well as phoneme discrimination. Sentence comprehension was impaired.

**Patient G.F.**

The patient is a right-handed M.D., the chief of an Orthopedic Ward in a county hospital. He suffered from a left hemisphere stroke at age 58, and was seen in the acute stage (approximately 3 weeks postonset). The neurological exam demonstrated a very mild right hemiparesis, with clear tactile extinction phenomena on the right and even more systematic visual extinction phenomena in the right visual field. The CT-scan showed a large hypodense area in the left temporal and parietal lobes. The neuropsychological exam demonstrated a severe memory disorder for auditorily presented stimuli. The language exam showed a fluent aphasia with severely paraphasic speech, and without articulatory or prosodic disorders. Naming was impaired, with frequent phonemic substitutions, anomas, and very few semantic errors. Transcoding tasks were severely impaired (more with nonwords than with words). Phoneme discrimination was moderately impaired. Single-word comprehension was mildly
impaired. Sentence comprehension was severely disrupted, errors resulting mostly in reversals of thematic roles or in the choice of morphologically related foils.

**Patient T.F.**

The patient is a right-handed male with a 5th-grade education. When he was 38, during cardiac catheterization, he had a right-sided seizure, followed by a transient right hemiparesis. He was seen on the first day postonset. The neurological and neuropsychological evaluations were normal. The language exam showed a fluent aphasia without clinically apparent articulatory and prosodic deficits. Naming and transcribing tasks were normal. Single-word and sentence comprehension were normal. The patient’s condition improved rapidly, and 1 month postonset no language deficits were detectable. A CT-scan, performed 2 years later, showed a very small lesion involving the parietal white matter in the left hemisphere.

**Patient F.G.**

The patient is a right-handed male, a Ph.D. student in Biology at the time of his illness. At age 19, he suffered from an intracerebral hematoma, after a very minor closed head injury. The speech sample analyzed for the present study was obtained 2 years postonset. At that time, the neurological exam showed a dense right hemiplegia, without sensory or visual defects. CT-scan demonstrated a hypodense area located in the white matter of the frontal, parietal, and (to a lesser extent) temporal lobes and an enlarged left lateral ventricle. The neuropsychological exam showed only a reduced digit span (span forward: 4). The language exam revealed a nonfluent, hypophonic speech, with articulatory disorders and a flat prosody. Transcribing tasks were mildly impaired with words, moderately impaired with nonwords. Most errors resulted in phonemic/orthographic distortions of the stimulus item. Sentence transcribing tasks showed agrammatic features. Naming tasks demonstrated anomias and occasional phonemic paraphasias. Action naming was more impaired than object naming. Phoneme discrimination and single-word comprehension were within normal limits. Reversible sentence comprehension was mildly impaired, all errors consisting either of reversal of thematic roles, or of the incorrect choice of a morphologically related picture.

**Patient G.G.**

The patient was a right-handed glazier, with an 8th-grade education. He had a stroke at age 58, and was tested 3 months and 14 months postonset. The second speech sample was used for the present study. The neurological exam showed a very mild, right hemiparesis. A CT-scan demonstrated a lesion involving the superficial and deep structures of the left frontal lobe. The neuropsychological exam was normal. The language exam demonstrated a nonfluent speech with moderate articulatory deficits. Naming and transcribing tasks were normal, except for the presence of articulatory disorders and of phonemic distortions. Phonemic discrimination, single-word comprehension, and reversible sentence comprehension were flawless.

**Patient M.L.**

The patient is a right-handed male with a high-school education, who held an administrative position at an Italian Embassy in Africa. At age 31, he had a cardiac arrest during minor surgery and fell in a coma. A week later the patient came out of the coma, and an aphasia was discovered. M.L. was seen in our Service 4 years later. The neurological exam was negative, and serial CT-scans failed to reveal any structural abnormality. The neuropsychological evaluation revealed only a mild difficulty in a task tapping the ability to learn a list of 15 words. The language exam revealed an aphasia with articulatory deficits and a flattened prosody. Naming and transcribing tasks were normal. Phoneme discrimination,
single-word comprehension, and reversible sentence comprehension were well within normal limits.

Patient A.M.

The patient is a right-handed male with an 8th-grade education. He worked as a clerk in the largest Italian travel agency. At age 49, he had a left hemispheric stroke. He was tested for the first time 4 years postonset. The neurological exam showed a very mild right hemiparesis and moderate-to-severe right-sided extinction phenomena in the tactile and in the visual modality. A CT-scan demonstrated a large hypodense area, involving the left temporal and the parietal lobes, both superficially and deeply. The left lateral ventricle was enlarged. The neuropsychological exam showed a mild buccofacial apraxia, a difficulty in learning lists of words and a reduced digit span (span forward: 4). The language exam demonstrated a severely nonfluent aphasia, free from any articulatory and prosodic deficits. Naming was severely impaired, more so for actions than for objects. Writing to dictation was severely impaired, whereas reading aloud and repetition were only mildly disturbed. Phoneme discrimination and single-word comprehension were only marginally impaired with comparison to a group of normal controls. Reversible sentence comprehension was impaired, almost all errors being thematic role reversals.

Patient B.P.

The patient was a right-handed woman with an 8th-grade education who, prior to her illness, worked as a laboratory technician. She had a left hemisphere stroke at age 40. She was tested approximately 9 years postonset. The neurological exam showed a dense right hemiplegia, and mild extinction phenomena on the right side in both the tactile and the visual modality. A CT-scan revealed a massive lesion in the left hemisphere, involving the entire territory of the middle cerebral artery and only sparing the mesial frontal and occipital areas. The neuropsychological exam showed buccofacial and limb apraxia and a severe verbal memory disorder. The language exam demonstrated a severely nonfluent aphasia with only mild articulatory disorders. Language tasks were severely impaired. B.P. was completely unable to transcode nonwords. In word reading, the patient displayed all the clinical signs of the deep dyslexia syndrome. Writing was substantially abolished, except for few, short, high-frequency words. Repetition was impaired. Naming was severely defective for objects and (even more) for actions. Phoneme discrimination and single-word and reversible sentence comprehension were severely impaired.

Patient C.S.

The patient is a right-handed female, without family history of left-handedness or of mixed hand preference. A retired high-school teacher with a Ph.D. in Education, she became aphasic at age 67, secondary to a right hemisphere stroke. She was tested approximately 1 year after the onset of her symptoms. The neurological exam showed a mild left hemiparesis and extinction phenomena on the left side of the body. The CT-scan showed a large hypodense area, involving the superficial and deep structures of the right frontal lobe, also extending deeply into the parietal lobe. The neuropsychological exam demonstrated buccofacial apraxia, severely reduced digit span (span forward: 2), inability to learn and retain lists of words, slightly reduced visual memory, and mild signs of left-sided neglect. The language exam showed a nonfluent aphasia with hypophonic speech, a mild dysarthria, and a flattened prosody. Nonword transcoding tasks were extremely impaired, whereas word transcoding tasks were relatively less defective; for both words and nonwords, repetition was less disturbed than reading and writing. In naming tasks, the patient produced some phonemic and semantic substitutions and showed anomic behavior. Action naming and action comprehension were very severely impaired, whereas object
naming and object comprehension were only mildly damaged. Phoneme discrimination was poor. Reversible sentence comprehension was markedly impaired upon auditory presentation. Visual sentence comprehension could not be tested, owing to the severe reading problem.

**Patient F.S.**

The patient is a right-handed male, who worked as a lawyer prior to his illness. He had a stroke in 1978, at age 52. He was seen for the first time 2 years postonset. The speech sample used for the present study was obtained 5 years postonset. The neurological exam showed a dense right hemiplegia, with tactile, visual, and auditory extinction phenomena on the right. A CT-scan showed hypodensity of the superficial and deep structures of the left temporal lobe, as well as of the deep structures of the parietal and of the frontal lobe. The neuropsychological exam showed a mild buccofacial apraxia and reduced verbal memory functions (span forward: 3). The language exam revealed a nonfluent aphasia with a "foreign accent" syndrome. Reading was very mildly impaired, whereas writing to dictation and repetition showed a severe impairment with nonwords, and a moderate impairment with words. In word repetition, a substantial number of inflectional errors was produced. Naming was mildly impaired for objects, moderately for actions. Phoneme discrimination was poor. Single-word comprehension was within normal limits. In reversible sentence comprehension tasks the patient produced a large number of reversal errors and morphologically based errors.

**APPENDIX 2**

**Patient A.A. (A.D.L.)**

[lavatevi]

[Chiamo] Luigi, Carla... [dico] "Su, via... lavare [vi],
[I call] Louis, Carla... [I say] "Up, away... wash [yourself]
Louis, Carla... "Hurry up... wash

prepare... cucino
preparare [vi], cosi... [Poi] cucinare. La sera... una volta una volta
prepare [yourself], so... [Then] to cook. The evening... one time one time
get ready, so."... Cook. In the evening... one time one time
e mezza,1 [faccio] la terapia e basta. E poi Luigi e Carla
and half, [I have] the therapy and enough. And then Luigi and Carla
and a half, therapy and that's it. And then Luigi and Carla
[sono] sempre qua, cosi' insomma, tutti i giorni. Cucino la sfoglia,
[are] always here, like this in sum, all the days. I cook the pastry,
always here, this way, everyday. I cook the pastry,
pulisco
faccio... [tolgo] [la] polvere, pulisci,... insomma, tutti i
I make...[I take off] [the] dust, clean (2nd sg)... in sum, all the
I make... the dust, clean (2nd sg)... in sum, all the

stiro.

giorni sono uguali... [faccio] [il] pranzo, batto i panni, stirare.
days are equal... [I make] [the] lunch, I beat the clothes, to iron.
days are the same... lunch, I clean the clothes, to iron.

**Patient F.A. (H.O.I.)**

Otto giorni [prima] di sposare[mi]... [sono] sceso

1 Meaning = an hour and a half.
Eight days before getting married, I had gone out from the house my with a motorbike. At the corner of the bridge of the S. of my house on a motorbike.

came out and hit me on the right side of the motorbike.

I was going wall in front, 8 days before married.

I got married 29 September '62.

At Rome I resulted that he had a hematoma.

Patient F.B. (H.O.I.)

[II] 20 luglio io [e] Laura andiamo a X. a mangiare.
[The] 20 July I [and] Laura go to X to eat.

Then of return [to] Y... Look, nothing, not even the father, the mother,

basta, niente. Poi [all'ospedale di X] [sono stata] operata.

siamo andati

Poi andiamo a Z. [a] novembre. Dopo e' proprio carrozzina.

Then we go to Z. [at] november. Later it's only wheelchair.

E poi a Z. [stavamo] a piangere.

Very thin. And then my mother dad and I at Z. to cry.

E poi adesso [sto] bene, e poi andiamo a Z., sempre a parlare.

And then now I am well, and then we go to Z., always to talk.

Patient C.D. (H.O.I.)


The 17 July 1979 I am called by the owners from the hospital.

2 Meaning = the administrative office.
On July 17, 1979 I am called by the owners from hospital that itself is freed a place and me were making go to make that a bed was available and that they let me go to have La l'operazione al cuore. Un'operazione al cuore era fatta the operation at the heart. A operation at the heart was made heart surgery. A heart surgery was made decido dal Dott.X. Il 24 decidere di farmi questa operazione, [a] me by Dr.X. The 24 to decide of making me this operation, [to] me by Dr.X. On the 24th decide to submit me to surgery, me e [a] un altro che stava nella camera operatoria. and [to] an other who was in the room operating. and another guy who was in the operating room. trattengono Io mi fanno l'operazione e me truttengo due giorni giu' di sotto. I to me they make the operation and me retain two days down of below. Me they make surgery and I keep me for two days downstairs.

Patient F.D. (H.O.I.)
Ecco che io venuto [nel] tarda pomeriggio. Here it is that I was come [in the] late (f.sg.) afternoon (m.sg.), Here it is—I had come late afternoon e mi ero un po' molto stanco. [Ero] venuto [dal] lavoro e and myself was a bit very tired. [I was] come [from the] work and and I was me a bit very tired. Come work and Ero [ero] molto stanco. Era anche un po' agitato. Era [l'] 8 settembre, [I was] very tired. He was also a bit agitated. It was [the] 8 September very tired. He was also a bit nervous. It was September 8, [una] giornata caldissima; ero tornato a casa mia, io pensavo [a] day very hot; I was come back at house my, I was thinking very hot day; I had come back to my house, I was planning [di] fare un bagno caldo perch' cosi' potevo essere piu' calmo. [to] do a bath hot because this way I could be calmer. take a hot bath because in this way I could calm down. Infatti [ho] aperto il bagno, [ho fatto uscire] l'acqua calda.. In fact [I have] opened the bath, [I have made to come out] the water hot.. In fact turned the faucet, hot water... [la] [vasca] [era] piena. Ho aperto [la] finestra. [the] [bathtub] [was] full. I have opened [the] window. full. I opened the window.

Patient C.D.A. (A.D.L.)
ho dormito Io [dormo] 5 ore. Alle 12 io ho dormito... io dormo. Alle 5 e mezzo I [sleep] 5 hours. At the 12 I have slept... I sleep. At the 5 and half I 5 hours. At 12 I slept... I sleep. At 5:30

1 Meaning = I go to sleep.
mi sono svegliato. 2 ore io... 5 ore io ho dormito. Alle 7 e mezzo
myself have awakened. 2 hours I... 5 hours I have slept. At the 7 and half
I woke up. 2 hours I... 5 hours I slept. At 7:30

sono alzato
the alarm clock [has rung]. At the 7 and half myself I get up
the alarm clock At 7:30 I get up

sono lavato
e sono andato in... nel bagno. Poi mi lavo le mani e
and I am gone to... to the bathroom. Then myself I wash the hands and
and I went to... to the bathroom. Then I wash my hands and

sono rasato
i piedi e il fronte. Poi io [mi] rado
the feet and the (m.sg.) forehead (f.sg.). Then I [myself] shave.
feet and forehead. Then I shave.

da

sono vestito
mi sono vestito. Poi sono andato in la cucina e prende la colazione
myself have dressed. Then I am gone to the kitchen and takes the breakfast.
I dressed. Then I went to the kitchen and takes breakfast.

Lavoro
Lavora [a] Milano. [Il posto] si chiama la X.
He works [at] Milan. [The place] itself calls the x.
Works Milan. It is called the X.
**Variation in Grammatical Morphemes**

*Patient E.D.U. (A.D.L.)*

Mi alzo verso 7 e mezza, vado nel bagno, mi [preparo]
Myself lift around 7 and half, I go to the bathroom, myself [prepare]

I get up at 7:30.
I go to the bathroom,

per la pulizia, mange [il] latte e poi dopo aiuto
for the cleaning, eat (nonword) [the] milk and then I help

to clean up, eat milk and then I help

la donna delle pulizie e cioè spolvera e aiuta a rifare i letti,
the woman of the cleaning and that is dusts and helps to remake the beds, the maid that is, dusts and helps to make the beds,

poi [vado] in cucina. Legge un pochino, [case] leggere
then [I go] to kitchen. Reads a little bit, [things] light (f.pl.)

then to the kitchen. Reads a little bit, light

che posso seguirlo perché le cose piu' difficili
that I can follow it because the things most difficult (f.pl.)
that I can follow it, because the most difficult things

capirle
I can understand it, I can manage to follow the...
To the contrary

le leggere
with the (m.sg.) things (f.pl.) most light (m.pl.) I manage to read.
with the lightest things I manage to read.

*Patient G.F. (A.D.L.)*

Faccio di
Do the physician, at the (m.sg.) morning (f.sg.) 

Fare il medico, al mattina [vado] [in] ospedale.
Be a physician, in the morning hospital.

Then [I go] [to] office, [to] bank, [I do] everything, here.

Then office, bank, everything, you see.

comincio
I to start at the 7 and half, [I work] until midnight. Then I had

I start at 7:30, until midnight. Then I had

tutta andavo
all (m.sg.) an activity (f.sg.) done.
all my activity done.

un'attività svolta. In più' andare [in] ospedale,
In more to go [to] hospital,

andavo hospital,

[I am] surgeon, I [am] orthopaedic.

Andare anche [in] ospedale
To go also [to] hospital

surgeon, I orthopaedics.

Andavo

[I am] surgeon, I [am] orthopaedic.

Also go hospital

operavo andavo

[il] giorno. Alle 7 e mezza - 8 operare. [II] pomeriggio andare

[8 hours] morning - 8 work. [II] afternoon go

(8 hours) morning - 8 work. [II] afternoon go
[the] day. At the 7 and half - 8 to operate. [The] afternoon to go
day. At 7:30 - 8:00 operate, Afternoon go
more [to] office than [in] hospital.
more office than hospital.

Patient T.F. (H.O.I.)

Non rivenuto dentro perché dolore continuamente sentire. Prendere
Come back in here because pain continuously feel. Take
miglioravo (drug X) a casa, ma... altre pastiglie, ma non migliorare. Allora io
(drug X) at home, but... other pills, but not to improve. Then I
gone [to the] neurologist, also because [the] cardiologist
gone neurologist, also because cardiologist
consigliava [di] [andare] [dal] neurologo. Allora [il] neurologo
recommended [to] [go] [to the] neurologist. Then [the] neurologist
recommended neurologist. Then neurologist
ha detto avrebbe dato
[to me] to say [that] [to me] to give [a] pill for sleep,
say give sleeping pill,
dormivo dormivo
ma io non dormire lo stesso; per due mesi notte e giorno non dormire
but I not to sleep the same; for 2 months night and day not to sleep
ne' con la camomilla ne' con [le] pillole.
neither with the chamomile nor with [the] pills.

Patient F.G. (H.O.I.)

Racconto il caso. Allora... Tanto lo sapete, quindi... Fumavo...
I tell the case. Then... Anyw.ay it you know, so... I was smoking...
I'll tell my case. Well... You know it, anyway, so... I was smoking a lot,
bevevo... Allora entro in casa. Il babbo [dice]:
I was drinking... Then I enter in house. The dad [says]:
I was drinking a lot... Then I go home. Dad
"Dove sei stato?" "In giro - rispondo - con le ragazze"
"Where you are been?" "In turn - I answer - with the girls"
"Where have you been?" "Around - I say - with some girls"
Il babbo non c'entrava niente; soltanto l'occhio sinistro
The dad not there was entering nothing; only the eye left
Dad had nothing to do with it; only my left eye
[sì] [e'] aperto. [Mi] [hanno messo] tre punti.
[itsel] [is] opened. [To me] [they have put] three stitches.
opeased.

contro il sono andato
Probabilmente ho battuto nel tavolo... e poi in coma...

Probably I have hit in the table... and then in coma... I was.

Gli amici [non] l'ho visti. E' meglio che [non] [li] rintracci

The friends [not] them I have seen. Is better that [not] [them] find.

My friends I have seen them. It's better if I find.

**Patient G.G. (A.D.L.)**

[Ero] [nei] medi... lui [era] [nei] massimi.

[I was] [in the] middleweight... he [was] [in the] heavyweight.

Io [ero] forte, [ma] [avevo] difficoltà [a causa delle] donne,

I [was] strong, [but] [I had] difficulties [because of the] women,

[dell] bere, [dell] fumo... Io non c'ero... non riuscivo [of the] drink, [of the] smoke... I not there was... not I was managing
drinking, smoke... My mind wasn't there... I could not

a fare... io [pensavo] [alle] donne, [al] bere, [al] fumo... to make... I [was caring] [about the] women, [to the] drink, [to the] smoke
make... I women, drinking, smoke

[ma] [il] pugilato [e'] [un] lavoro serio. Amici,... X, Y, Z, e io...

[but] [the] boxing [is] [a] job serious. Friends,... X, Y, Z, and I...

[eravamo] tutti pugili... pure io... [Avevo] [un] carattere litigioso

[were] all boxers... also I... [I had] [a] temper bad

all boxers... me too... bad temper

**Patient M.L. (H.O.I.)**

Quel giorno [ad] un orario stabilito ci sono andato.

That day [at] a time established there I am gone.

Lui m'ha portato in sala [da] operazione e... Ma io da allora

He me has taken in room [of] operation and... But I since then

He took me to the operating room and... But since then I

ricordo solamente [il] suo viso. Allora da ciò' che mi e' stato detto
remember only [the] his face. Then from that to me has been told
only remember his face. Then from what has been told to me

sono subito... Appena fatta l'anestesia... L'operazione dicono
I am immediately... As soon done the anesthesia... The operation they say
I am immediately... As soon as the anesthesia was done... Surgery they say

che non [e'] riuscita. In quel momento il cuore si era fermato
that not [has been] successful. In that moment the heart itself was stopped
that was not successful. In that moment my heart stopped

[mi] pare due volte, due o tre, non ricordo bene.

[to me] it seems two times, two or three, not I remember well.

think two times, two or three times, I do not remember well.

**Patient A.M. (A.D.L.)**

Subito [metto] [le] scarpe. No! Prima... come si dice, ecco...

Right away [I put on] [the] shoes. No! Before... how it says, here...
Right away shoes. No! Before... how do you say, here...

Dopo poi [vado] [al] bagnoe come ho detto [faccio] [la] barba
After then [I go] [to the] bathroom and as I have said [I make] [the] beard

Then

pulisco pulisco

poi [i] dentipulire... pulire [i] denti... poi [lavov] [i] capelli.
then [the] teeth to clean to clean [the] teeth... then [I wash] [the] hair.

Then teeth clean... clean teeth... then hair.

pulisco

Poi io... quindi pulire[mi], va bene,... e poi... e [metto]
Then I... then to clean [myself], goes well,... and then... and [I put on]

Then I... then clean, all right,... and then... and

[i] vestiti... Poi mi preoccupo [di] papa' che non fa niente.
[the] clothes... Then myself worry [of] dad who not does nothing.

clothes... Then I take care dad who does not do anything.

Devo aiutarlo io perché non ha... E per papa' vengo [a] mangiare
I must help him I because not he has... And because of dad I come [to] eat

Must help him myself because he hasn’t... And because of dad I come eat

[al] [casa]. . . Poi [vado] a scuola.4
[at] [home]... Then [I go] to school.

Then to school.

Patient M.M. (H.O.I.)

Dunque... [sono stato] ricoverato a S. per i esami. Dopo 15 giorni...
Well... [I have been] admitted to S. for the exams. After 15 days...

Well... admitted to S. for a check-up. 15 days later...

gli esami

Allora... un giorno... 15 giorni... l’esame a S.... dopo poi... prima di...
Then... a day... 15 days... the exam at S... after then... prior of...

Then... one day... 15 days... the exam at S... then later... before...

[a]l’orario della cena... allora... sono svenuto, e allora...
[at] the time of the dinner... then... I am fainted, and then...

dinnertime... then... I fainted, and then...

[ho fatto] [il] ricovero a G. [Sono stato] un giorno a S. e poi
[I have made] [the] admission to G. [I have been] one day at S. and then

admission to G. One day at S. and then

ero... a G. E [per] 4 o 5 giorni non è’ cosciente. Dopo poi ha preso
ho to G. And [for] 4 or 5 days not is conscious. After then has taken
to G. And 4 or 5 days is not conscious. Then later has gained

mancava Perdevo

consciousness. But... [to me] misses the strength. I lose the balance.

Consciousness. But... strength is missing. I lose balance.

[Per] 40 giorni [sono stato] ricoverato a S. per broncopolmonite.
[For] 40 days [I have been] admitted at S. for bronchopneumonia.

40 days admitted at S. for a bronchopneumonia.

4 Meaning = to therapy.
VARIATION IN GRAMMATICAL MORPHEMES

Patient P.B. (C.T.)

La bambina e'... ha fatto precipitare [i] biscotti. Poi l'acqua [cade]
The girl is... has made to fall [the] cookies. Then the water [falls]
The girls is... has caused cookies to fall. Then the water [falls]
per terra. Lavare, poi... [con lo] straccio lavare, asciugare poi...
for ground. To wash, then... [with the] mop to wash, to dry then...
on the floor. Wash, then... mop wash, dry then...
ha
ho sporcato tutto.
I have dirtied everything.
have messed up everything.

(A.D.L.)

pulisco
Dunque [a]le 6:30 [durante] la settimana pulire. [Ho] 5 camere
Well [at] the 6:30 [during] the week to clean. [I have] 5 rooms
Well 6:30 the week clean. 5 rooms
Pulisco e accessori. Pulire tutto. [Faccio] la pizza. [i] funghi
and accessories. To clean everything. [I make] the pizza, [the] mushrooms
e [i] funghi, un chilo, un chilo e mezzo, tanti... la spesa
and [the] mushrooms, one kilo, one kilo and half, many... the shopping
and mushrooms, one, one and a half kilo, many... the shopping
tutto
[per] tutta il mese la compro.
all month I buy it.

Patient C.S. (A.D.L.)

I wash first everything. At the morning I put on [the] skirt.
First a wash everything. In the morning I put on skirt.
Poi dopo [faccio] il bagno. [Mi] [asciugo] [con] l'asciugamano,
Then after [I make] the bath. [Myself] [dry] [with] the towel,
Then later the bath. The towel,
Poi dopo lavo, e poi dopo cosi'. Quindi [faccio] gli esercizi,
Then later I wash, and then like this. Then [I do] the exercises,
Then later I do the laundry, and then like this. Then the exercises,
[gli] esercizi sempre. E poi dopo la mia figlia si va a scuola.
[the] exercises always. And then the my daughter herself goes to school.
exercises always. And then the my daughter goes herself to school.

mi metto
Poi mangiamo e poi dopo si mette a dormire. E poi dopo
Then we eat and then later herself puts to sleep. And then later
Then we eat and then later goes to sleep. And then later
come si desta il sole, allora [faccio] la passeggiata.

\^ Meaning = as soon as the sun sets.
as itself wakes the sun, then [I make] the walk.
as soon as the sun awakes, then the walk.

**Patient F.S. (A.D.L.)**

ritorno a casa mia
Then returns [to] the my house.

Poi ritorna [a] la mia casa.

Poi io ascolto il televisione
Then I hear the (m.sg.) television

Then returns my house.
Then I hear the television

faccio vivo

o poi fare il pranzo perch'è, caro dottore, io vive solo!
or then to do the lunch because, dear doctor, I lives alone!

or then make lunch because, dear doctor, I lives alone!

ricevo faccio

Poi telefono, riceve, fare, perch'è giornate
Then I telephone, receives, to make, because the (m.sg.) days (f.pl.)

Then I telephone, receives, make, because the days

lunghi

[sono] lungo.

Poi ancora spesso andare [allo] studio.
[are] long (m.sg.). Then again often to go [to the] office.

long. Then again often go office.

i Parioli

[In] Via C. [a] il Pariolo c'è
[In] Street C. [at] il Pariolo there is

Street C. il Pariolo there is

il mio studio

la mia studia ancora aperto.

the (f.sg.) my (f.sg.) office (f.sg. -incorrect N gender) still open (m.sg.)

my office still open.

**Patient L.S. (A.D.L.)**

Prendo 1 friggo

Prende una olio, poi una cipolla. Poi [metto] [il] burro, poi [lo] frigge

He takes an oil, then an onion. Then [I put] [the] butter, then [it] fries

Takes an oil, then an onion. Then butter, then fries

dunque... poi va in acqua. Dopo, ecco... pomodori e prezzemolo e

well... then goes in water. Then, here... tomatoes and parsley and

well... then it goes in the water. Then, here... tomatoes and parsley and

faccio bollire

ragu' e sale. Mescolo e bolle piano piano. Allora metto

ragout and salt. I stir and it boils slowly. Then I put

ragout and salt. I stir and it boils slowly. Then I put

la pentola con [l'] acqua... no, [con] l'acqua è sale. Butto dentro

the pan with [the] water... no, with the water and salt. I throw in

the pan with water... no, water and salt. I throw in

la pasta. Si mescola. [Si] mette ancora in pentola, poi [si] [aggiunge]

the pasta. It stirs. [It] puts again in pan, then [it] [adds]

the pasta. You stir. Put again in the pan, then


[the] ragout. Then [it] stirs, then [it] [adds] the cheese.

ragout. Then stir, then the cheese.
**VARIATION IN GRAMMATICAL MORPHEMES**

*Patient M.U.* (A.D.L.)

Mi
L'allo poi [vado] [in] bagno e poi metto un po' di...
It get up then [I go] [to the] bathroom and then I put a bit of...
I get it up then
bathroom and then I put a bit of...

il coso li'... Lavo la faccia e poi vado in casa e poi prendo
the thing there... I wash the face and then I go in house and then I take
that thing there...I wash my face and then go in the house and then I take
un po' di caffè: E poi aspetto che la M. porta il campanello e vado via.
a bit of coffee. And then I wait that the M. brings the ring and go away.
some coffee. And then I wait until M. brings the ring and go away.

vado studio
Poi adesso quando andare alla... la M. perche' studiare [la] parola
Then now when to go to the... the M. because to study [the] word
Then now when go to the... the M. because study word

nel e poi vado in il [Noun] sotto... e poi vado... andare al salotto
and then I go in the [Noun] below... and then I go... to go to the room
and then I go in the [Noun] below... and then I go... go to the room

studia
E poi viene E. e studiare anche lui perche' parlare... perche' spesso
And then comes E. and to study also him because to talk... because often
And then E. comes and he study as well because to talk... because often
non parlo mica.
not I talk really.
I really don't talk.

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