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On the Preservation of Word Order in Aphasia: Cross-Linguistic Evidence

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Studies of language production in English-speaking aphasics (both fluent and nonfluent) generally lead to the conclusion that word order is preserved to a much greater degree than grammatical morphology and/or lexical retrieval. However, because word order is rigidly preserved even in normal English speech, this pattern might reflect nothing more than "the weak link in the chain." Using a constrained production paradigm, we provide evidence showing that canonical sentence order is well preserved in both fluent and nonfluent patients, in Italian and German (languages that permit much more pragmatic word-order variation) as well as English. Patients also retain the ability to order nouns around a preposition, and among Italian patients, access to a high-frequency form of pragmatic word-order variation is also retained. Syntactic difficulties seem to revolve not around loss of ordering principles, but (1) reduction in syntactic complexity, (2) overuse of canonical word order as a "safe harbor," (3) blend errors in which a form appears in legal but semantically incorrect position, and

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(4) abandonment of the effort to produce a complete sentence under stressful conditions. We offer a redefinition of syntactic impairment as a problem in the access of phrase structure types, resulting in a preference for higher frequency forms. Parallels between lexical retrieval and phrase structure retrieval suggest that similar mechanisms may be at work in both cases.

Most modern studies of grammatical impairment in aphasia have been carried out with patients who are (or were) native speakers of English. Because English is rare among natural languages in its rigid preservation of word order, this leads to some concerns about the generalizability of existing evidence on the sparing and impairment of syntactic structure. In this paper, we will present some comparative evidence on the syntactic abilities and disabilities of fluent and nonfluent aphasics in three Indo-European languages: English, Italian, and German. In all three languages, the basic or pragmatically neutral word order is Subject-Verb-Object, or SVO. However, Italian and German permit far more variation of basic constituent ordering, permitting us to compare preservation of syntactic ability in "strong" versus "weak" word-order types. Although this is certainly not a representative sample of the world's languages, the results will provide some useful qualifications and extensions of English-based theories of grammatical processing in aphasia. In particular, we will present evidence suggesting that basic ordering principles are resistant to brain damage across natural languages—even in languages that permit extensive word-order variation. These findings contrast markedly with existing evidence on morphological and lexical deficits in the same patients. If this profile of sparing and impairment holds up across languages and performance modalities, then it may provide the basis for a unified lexicalist account of grammatical breakdown in both fluent and nonfluent aphasia.

Our argument will revolve around a distinction between two different kinds of syntactic impairment: word-order errors (i.e., errors in which constituents are placed in the wrong position relative to other elements in an utterance) and reductions in phrase structure complexity—including an avoidance of more complex and/or marked morphosyntactic constructions. We will suggest that errors of the first type are rare, and can usually be reinterpreted as confusions at a lexical level. Errors of the second type are quite common, and can be accounted for by several competing models of the way that phrase structures are accessed and implemented in language production. These models have one thing in common: phrase structures are viewed as a kind of complex lexical item, and retrieval of phrase structures depends on lexical access factors like frequency and/or markedness. Taken together, these results will suggest a revision of the original distinction between syntax and morphology, in favor of a distinction between *item retrieval* (regardless of the size of the item) and *item ordering* (including the order of constituents within a sentence, and the order of morphemes within a word or phrase). We

will argue that grammatical breakdown in aphasia revolves primarily around deficits in item retrieval (although such deficits may take somewhat different forms in fluent and nonfluent aphasia); by contrast, knowledge of ordering principles (in syntax and morphology) tends to be preserved. This contrast between item retrieval and item ordering cuts across the more traditional boundary between morphology and syntax in linguistic theory and suggests a somewhat different view of the organization of mind and brain for language processing.

Two kinds of background information are necessary before we can present our results:

(1) A brief discussion of recent problems in the literature on grammatical impairment in aphasia, with a particular emphasis on the distinction between syntax and morphology in both receptive and expressive language.

(2) A description of some differences among English, Italian, and German that are particularly relevant for this cross-linguistic study of word order and syntactic structure in fluent and nonfluent aphasics.

Morphology and Syntax in Aphasia

Traditionally, the syntactic component of a natural language is defined in terms of the rules and principles that govern hierarchical structure and ordering of constituents in simple and complex sentences. By contrast, the morphological component is defined in terms of the rules governing bound morphology (i.e., the suffixes, prefixes, and infixes that can be used to build words and to modify lexical "roots"). The term "morphology" is sometimes extended to include free-standing grammatical morphemes as well, i.e., the small set of high-frequency words that serve a primarily grammatical or "phrase-building" function. These include determiners, pronouns, verb auxiliaries, prepositions, and a limited set of adverbials and other particles. The boundary between morphology and syntax is not always easy to establish (for detailed discussions, see Kean, 1979; and Anderson, 1982). For example, pronouns and prepositions can also play a major role in syntactic structure, e.g., as heads of phrases. Nevertheless, the distinction has proven useful in many aspects of linguistic and psycholinguistic research (c.f., Friederici, 1986).

In the English-language literature on aphasia, we find two different approaches to the relationship between morphology and syntax: *unified grammar* and *the closed-class hypothesis*.

Unified grammar. Proponents of this approach have dropped the distinction between morphology and syntax completely, describing aphasic symptoms in terms of a unitary grammatical processor that can be selectively spared or impaired. Indeed, the word "syntax" is sometimes used as a synonym for grammar as a whole (e.g., Caplan, 1981; Gleason, Goodglass, Green, Ackerman, & Hyde, 1975; but see Goodglass & Menn, 1985). To some extent, this is simply a terminological habit, demonstrating

the influence of generative linguistic theory on English-speaking aphasiologists. Chomsky (1957, 1965, 1981) has consistently used the term "syntax" to refer to grammar as a whole, a tendency which in turn reflects the important role that data on English have played in the development of his theory. However, the more general tendency to treat grammar as a unified component also grew out of a large literature in the 1970s, demonstrating that patients with agrammatic symptoms in their expressive language have parallel problems in receptive processing, if they are forced to rely entirely on morphosyntactic elements to interpret sentences. For example, a patient may have no difficulty with complex embedded sentences like "The apple that the boy ate is red," but perform quite poorly with sentences like "The girl that the boy chased is tall" (Zurif & Caramazza, 1976; see also Heilman & Scholes, 1976; Von Stockert & Bader, 1976; Goodglass et al., 1979). This kind of result led to a characterization of agrammatism as a central deficit, implicating the same grammatical elements in every modality (Caramazza & Berndt, in press; see chapters in Kean, 1985, for an extensive discussion).

As we now know, there are serious problems with the original formulation of "central agrammatism." First, there are several published cases of expressive agrammatism in patients who perform normally in grammatical comprehension tasks (Kolk, van Grunsven, & Guper, 1982; Miceli, Mazzucchi, Menn, & Goodglass, 1983; Naeser, Haas, Auerbach, Helm-Estabrooks, & Levine, 1984). Second, there are even more cases of receptive agrammatism in patients with fluent and grammatically well-formed speech (Bates, Friederici, & Wulfeck, 1987; Caplan, 1985; Caramazza, Berndt, Basili, & Koller, 1981; Smith & Bates, 1987). Third, recent studies have demonstrated that many so-called agrammatic patients retain the ability to make judgments of grammaticality (Crain, Shankweiler, & Tuller, 1984; Linebarger, Schwartz, & Saffran, 1983; Wulfeck, in press).

In the wake of this confusion, it has become particularly important to determine *which* aspects of grammar present difficulty for *which* patients, in both receptive and expressive language tasks. This brings us to a consideration of the closed-class hypothesis, a somewhat weaker claim about the scope of grammatical deficits in Broca's aphasia, with implications for other forms of aphasia as well.

The closed-class hypothesis. Proponents of this approach have argued that grammatical deficits in Broca's aphasia involve a selective impairment in the patient's ability to process grammatical morphemes; other aspects of syntactic structure may be left intact. Two different lines of evidence can be cited in support of this view.

First, the closed-class hypothesis is compatible with traditional studies of free speech and/or elicited production in aphasia. Most of these studies have concluded that violations of basic word order are rare, for both

fluent and nonfluent aphasics (Goodglass & Kaplan, 1983; Gleason et al., 1975; Menn & Obler, in press). Similar conclusions emerge from studies of metalinguistic processes in aphasia, demonstrating that both fluent and nonfluent patients are able to use canonical sentence order. For example, Ansell and Flowers (1982) have shown that English Broca's and Wernicke's aphasics can order words written on cards to create a simple but well-formed sentence in their native language (see also Kolk & van Grunsven, 1985). When patients fail to order constituents correctly in this kind of metalinguistic task, their errors seem to be due to a confusion over the role of function words in building up a noun or verb phrase (Caramazza et al., 1981; Zurif, Green, Caramazza, & Goodenough, 1976), and not to the order of major constituents within a phrase or clause.

Other support for the closed-class hypothesis comes from studies of receptive processing, in particular studies that focus on the patient's ability to process free-standing grammatical function words, inside and outside of a sentence context (Bradley, Garrett, & Zurif, 1980; Friederici & Schoenle, 1980; Friederici, Schoenle, & Goodglass, 1981; Swinney, Zurif, Rosenberg, & Nicol, 1984). The details of these studies vary (and do not always replicate—see Gordon & Caramazza, 1982). But the main point seems to be that agrammatic Broca's aphasics are impaired in the way they process grammatical function words—precisely those items that are missing or deviant in the same patients' spontaneous speech. Several versions of the closed-class hypothesis have now been proposed to account for grammatical disruptions in aphasia (Caramazza & Berndt, 1978; Friederici & Schoenle, 1980; Kean, 1979; Grodzinsky, 1982; Zurif & Grodzinsky, 1983). These proposals differ on several key points (e.g., Kean locates the problem at the phonological level; for Zurif & Grodzinsky, the difficulty lies within the grammar). But they all restrict agrammatism to a problem with closed-class elements.

If closed-class theories of agrammatism and paragrammatism prove to be correct, then we will have markedly reduced the range of alternative explanations for aphasic disorders. *Specifically, agrammatism, paragrammatism and anomia could all be viewed as disorders of lexical access.* The patient's apparent difficulty in comprehending or producing complex phrase structures would be attributed to a difficulty in accessing the inflections and function words necessary to complete those structures, and/or a difficulty in retrieving the content words needed to complete a certain sentence plan. We would, of course, still need to explain how different **aspects** of the lexicon can be dissociated from one another (e.g., content words versus function words, nouns versus verbs). In other words, the double dissociations observed in aphasia research do not disappear simply because we have moved them into the lexicon. But we could at least restrict our focus to the complex but delimited processes

of item retrieval (see also Miceli, Silveri, Villa, & Caramazza, 1984). This would, in turn, permit us to frame our hypotheses within one of several rich and detailed theories of lexical access (Morton, 1970; Marslen-Wilson & Tyler, 1980; McClelland & Rumelhart, 1981; Swinney, 1979; Seidenberg & Tanenhaus, 1986). Furthermore, a lexicalist approach to aphasia could draw upon a growing lexicalist movement within the field of linguistics (Bresnan, 1978, 1982; MacWhinney, 1987; Pinker, 1984).

Unfortunately it is difficult to decide between the unified grammar approach and closed-class theories, because morphology and syntax are naturally correlated and hence confounded in most research on grammatical impairment in aphasia. For example, in studies of receptive processing there are several reasons why a patient might fail to interpret sentences like "The girl that the boy chased is tall." The problem might pervade every aspect of the grammar, including both syntactic and morphological aspects of parsing and interpretation. Alternatively, a patient with perfectly preserved knowledge of positional constraints might nevertheless fail on these items because of a difficulty in the recognition and/or interpretation of function words, e.g., the relative clause marker "that."

A similar argument applies to studies of spontaneous speech, where it is often very difficult to distinguish between word-order errors and errors of morphology (Bates, Hamby, & Zurif, 1983). For example, suppose that a patient describes the famous Cookie Theft picture (Goodglass & Kaplan, 1983) with the sentence "Cookie take boy." This utterance could be classified as a syntactic error, i.e., an inappropriate Object-Verb-Subject (OVS) construction that violates the basic SVO order of simple English sentences. There is, however, another way of looking at the same mistake. Perhaps the patient was actually trying to produce a target structure like "The cookie is being taken by the boy." This kind of structure would be pragmatically appropriate if, for example, the patient were answering a question like "What's happening to the cookies?" However, if this patient lacks the grammatical morphology necessary to differentiate the intended passive construction from a simple OVS, he would end up producing a sentence that appears to be an accidental permutation of SVO. Unless we know a great deal about the patient's communicative target (a condition that is rarely met, at least in studies of free speech), it is difficult to distinguish between these two interpretations.

A different kind of ordering problem might result if the patient has marked difficulties in retrieving content words (Bates et al., 1983). If the patient begins his sentences according to some kind of "first come, first serve" principle (e.g., Bock, 1982), he may start a sentence from a point of view that is difficult to finish off. Take, for example, a situation in which a fluent patient is trying to describe a picture in which an old woman gives a present to a girl. Suppose the patient is able to retrieve

the word "girl" first; he begins his description from that point of view, saying "The girl . . ." and rapidly finds himself in serious difficulty locating the relevant verb. Because the verb "give" is more frequent and less marked than the corresponding verb "receives," the patient may end up producing an erroneous sentence like "The girl . . . is giving a present." Superficially, this could be viewed as a word-order error, with the object assigned to the wrong position. But in this case, the underlying cause of the confusion would be lexical rather than syntactic. (For some related arguments concerning the nonsyntactic basis of sequencing errors in fluent aphasia, see Buckingham & Kertesz, 1976; and papers in Brown, 1981).

There is another way of defining syntactic deficits, in addition to the issue of ordering violations. One of the defining symptoms of Broca's aphasia is a tendency toward reduced phrase length, with a virtual absence of complex sentence constructions (e.g., relative clauses, or passives—but see Heeschen, 1985). To a lesser extent, the same is true for Wernicke's aphasics, who tend to produce only a restricted subset of possible phrase structures within their otherwise fluent speech (Gleason, Goodglass, Obler, Green, Hyde, & Weintraub, 1980). Even if the patient produces nothing but syntactically well-formed utterances, such an abnormal reduction in syntactic complexity could involve an impairment at the level of syntactic planning, reflecting the loss or reduced availability of certain syntactic frames. However, this symptom could also result secondarily from problems at a nonsyntactic level. In fact, there are at least three independent reasons why a patient might avoid complex and/or marked syntactic frames, none of which require us to postulate loss of syntactic structure per se.

(1) *Avoidance of complex morphology.* Complex syntactic structures often contain a larger number of difficult grammatical morphemes (e.g., the morphology required for the passive). Hence, even though the patient understands the structure and function of these complex forms, he may avoid them because of the morphological retrieval problems that the pose. The plausibility of this argument is buttressed by the finding that agrammatic patients retain some ability to detect a variety of grammatical violations, despite impairments in their own speech (Linebarger et al., 1983; Wulfeck, in press).

(2) *Avoidance of Phonological Complexity.* In languages like Italian, where word-order variations are quite common (see below), it is usually the case that noncanonical word-order patterns carry some kind of contrastive stress. Hence, in addition to their baseline frequencies, pragmatically marked phrase structures also tend to require more marked and/or complex suprasegmental phonology—for example, the contrast between "I'd like to see that" and the topicalized, left-dislocated form "That I'd like to see!". If a patient has problems at the level of articulatory

planning and output, he may avoid marked phrase structures because of the additional load that they impose on the motor system.

(3) *Cognitive Overload.* Two syntactic structures that are equivalent in both morphological and phonological complexity may nevertheless vary in their frequency and/or "markedness." A patient who is experiencing problems in the retrieval of specific lexical/morphological items may compensate for his stressed and overloaded item retrieval system by sticking with syntactic structures that are particularly easy to access and execute (Kolk & van Grunsven, 1985; Lapointe, 1985; Stemberger, 1984).

Although it is difficult to unconfound morphology and syntax under natural conditions, there are experimental procedures that enable us to differentiate between the unified grammar approach and the closed-class hypothesis. In a recent study of sentence comprehension abilities in English, Italian, and German aphasics (Bates et al., 1987), we used sentence stimuli that represent competing and converging combinations of basic word order, semantic reversibility, and subject-verb agreement. With these stimuli, we were able to assess different degrees of sparing and/or impairment in syntax and morphology, respectively. Results suggest that patients in all three language groups retain normal and language-specific use of canonical word order to comprehend simple sentences; by contrast, the same patients were markedly impaired in their ability to use morphological cues to meaning. This pattern of differential sparing and impairment is important, because it demonstrates a selective impairment of morphology in receptive processing even in languages that are extremely dependent on morphological cues to sentence meaning. However, the effect is visible only in controlled circumstances where we can vary syntactic and morphological cues separately.

In the present study, we will try to unconfound morphological and syntactic processes in sentence production, in the same language and patient groups that Bates et al. (1927) investigated from the point of view of sentence comprehension. As we shall see, the results provide further support for the view that ordering principles are preserved in aphasia, a finding which is in turn compatible with a lexicalist approach to grammatical impairment. However, we have to issue two caveats before presenting these results.

First, even if reports of word-order errors are rare in the literature, there are a few cases on record (e.g., Saffran, Schwartz, & Marin, 1980; Schwartz, 1986; Tissot, Mounin, & Lhermitte, 1973; see Goodglass & Menn, 1985, for a review). These exceptions must be accounted for in a principled way, before we can take a lexical account of aphasia too seriously. We will try to provide such an account later, with reference to our own cross-linguistic findings.

Second, before speculating on the advantages and disadvantages of a

purely lexical model of aphasia, we first need to determine whether the findings that buttress such a model generalize past English. As we shall see, there are several reasons to expect rather different symptom patterns in other languages.

Language Differences and their Implications for Aphasia Research

Most of the above-cited research on agrammatism and paragrammatism has been carried out with English-speaking patients. English is, however, quite unusual among the world's languages for its heavy reliance on word-order principles, in particular a rigid preservation of the order SVO in most sentence types. This strong emphasis on word order is accompanied (and perhaps caused) by an unusually impoverished system of both noun and verb phrase morphology. We might expect grammatical breakdown to look very different in a language that is organized along different lines.

Italian and German both provide an interesting contrast to English in this regard. German is a case-inflected language, i.e., a language in which morphological markers indicate "who did what to whom." Italian (like English) has preserved ancestral case markers only in the pronoun system e.g., *I* vs. *me, we* vs. *us, he* vs. *him*. In other respects, however, Italian is much more similar to German. For example, in both languages noun modifiers must agree with the governing noun in number, gender, and/or case. We find noun/modifier agreement in English only for a small set of quantifier terms (e.g., "many birds" vs. "one bird"). In the same vein, English has a rather minimal system of verb morphology, including conjugations for person and number as well as markings for tense and aspect. Consider, for example, the series *I eat, you eat, he eats, we eat, they eat*. The Italian equivalent would be *io mangio, tu mangi, lui mangia, noi mangiamo, loro mangiano*—and that does not even include the alternative markings for formal versus informal and singular versus plural *you*. The German system is not quite so richly marked, but there are still far more agreement contrasts on the German verb than we have in English.

Through some combination of noun and verb morphology, most of the world's languages convey enough information about sentence meaning that they can vary word order for other purposes, i.e., to topicalize or focus on different pieces of information. In the service of this kind of pragmatic function, Italian permits all possible orderings of Subject, Verb, and Object in simple sentences (see Table 1). Furthermore, because of their rich system of agreement markers, Italians are able to omit the subject roughly 70% of the time in informal conversation (Bates, 1976; see Rizzi, 1980, for a discussion of so-called "pro-drop" parameter in Italian). German does not permit subject omission to the same degree, and the German system of word-order variation is more constrained, with biases toward SVO, SOV, and VS constructions. Nevertheless,

TABLE 1
WORD-ORDER VARIATION IN ITALIAN

Word-order type	Italian	English translation
1. SVO	Io mangerei un primo.	I would eat a first course.
2. OSV	La pastasciutta Franco la prende sempre qui.	Pasta Franco it orders always here.
3. VSO	Allora, mangio anche io la pastasciutta.	Well then, am eating also I pasta.
4. VOS	Ha consigliato la lasagna qui Franco, no?	Has recommended the lasagna here Franco, hasn't he?
5. OVS	No, la lasagna l'ha consigliata Elizabeth.	No, the lasagna it has recommended Elizabeth.
6. SOV	Allora, io gli spaghetti prendo.	In that case, I the spaghetti am having.

Note. From "Cue Validity and Sentence Interpretation in English, German, and Italian" by B. MacWhinney, E. Bates, & R. Kliegl, 1984, *Journal of Verbal Learning and Verbal Behavior,* p. 133. Copyright 1984 Academic Press, Inc. Adapted by permission.

word order is still far more variable in German than in English. In the absence of a rich inflectional system, English speakers cannot afford to take liberties with the ordering and/or omission of major constituents.

In a series of cross-linguistic studies with normal children and adults, MacWhinney and Bates have shown that this relative "weighting" of word order versus morphology has drastic effects on the way that adults behave in sentence-processing studies, and on the order in which these aspects of grammar are acquired by children (Bates & MacWhinney, 1987; MacWhinney, Bates, & Kliegl, 1984; MacWhinney, Pleh, & Bates, 1985; MacWhinney, 1987; MacWhinney & Bates, in press). In languages that are oriented toward word order, basic or canonical word order is learned very early and plays a major role in sentence comprehension and sentence planning throughout life. In languages that are oriented toward morphology, grammatical morphemes are acquired much earlier by children and emphasized much more heavily in adult sentence processing. MacWhinney and Bates capture these quantitative and qualitative differences among languages in a probabilistic model of grammatical processing called *the competition model.* If this model is correct, then these cross-linguistic differences in the "weighting" of morphology and syntax should also play a role in determining the way that language breaks down under focal brain damage. In English, we would expect syntax to remain strong relative to morphology—not because of the way the brain is organized to carry out language processing, but simply because the "weak link in the chain" is more likely to suffer under conditions of stress. By contrast, in heavily inflected languages we should find the opposite configuration: a relatively greater sparing of closed-class elements,

accompanied by relatively more impairment in the use of word-order principles. Because this weak-link hypothesis pertains to *any* kind of stress on language processing, cross-linguistic effects should be the same for both fluent and nonfluent aphasic patients.

Alternatively, if the closed-class hypothesis has cross-linguistic validity, then we should expect to find relative sparing of word-order principles and relative impairment of morphology—even in heavily inflected languages that permit extensive word-order variation. Support for the closed-class hypothesis would be even stronger if we find evidence for the preservation of *both* canonical and noncanonical word-order patterns in languages that permit extensive variation of word order for pragmatic purposes.

These competing predictions will be tested in the "given–new task," a picture description procedure that was first used by MacWhinney and Bates (1978) in a study of normal children and adults in three distinct language groups (English, Italian, and Hungarian). In this procedure, native speakers are asked to describe a series of three-picture cartoons depicting simple transitive and intransitive events. In each picture triplet, one element varies (i.e., the actor, the action, the object, or the dative recipient of an object) while the others remain constant (e.g., a little girl is first pictured eating an apple, then a cookie, then an ice cream cone). This gives us control over both the semantic and pragmatic structure of the event to be described. Since we know so much about the range of target utterances that a speaker may have in mind, our analyses of word order and structural complexity can be based entirely on the objective picture constraints (i.e., the syntactic structure that *ought to be there*.) We do not have to rely on the morphology produced by the patient to make our interpretations of the intended subject, verb, and object roles. In other words, we can unconfound syntax and morphology.

The given-new paradigm was adopted by Bates et al. (1983) to study the effects of focal brain damage on pragmatic expression in English-speaking Broca's and Wernicke's aphasics. We have now extended the same procedure to Broca's and Wernicke's aphasics who are monolingual native speakers of Italian and German. The resulting English, Italian, and German data base provides a rich source of comparative information about expressive language in aphasia.

Bates, Friederici, and Wulfeck (in press) have presented a detailed cross-linguistic analysis of grammatical morphology in this data set. They demonstrate considerable evidence for disruption of morphology in *both* fluent and nonfluent aphasia, in all three languages (although the patterns of sparing and impairment vary quantitatively and qualitatively from one language to another). Such findings contrast markedly with the patterns of word-order preservation that we will present here.

Wulfeck, Bates, Friederici, and Zurif (in preparation) have analyzed the same data from a pragmatic perspective; they have shown that all

the patients in this study are sensitive to the given–new constraint, evidenced in a tendency to lexicalize new information and to pronominalize or omit old information. They also report that the patients make normal use of definite and indefinite articles to convey the given–new contrast, when they produce articles at all. Hence we know that the patients in this study demonstrate a dissociation between grammatical morphology (which is significantly disrupted) and the pragmatics of givenness and newness (which is clearly preserved). We also know that this pattern of sparing and impairment holds for both fluent and nonfluent patients, although the two groups do differ in other respects.

With a very few exceptions, the same patients who contributed to this expressive language corpus also participated in the cross-linguistic study of sentence comprehension reported by Bates et al. (1987). As noted earlier, all the patients in that study evidenced problems with the use of subject-verb agreement as a cue to sentence meaning; by contrast, they all demonstrated normal or near-normal use of canonical word order in comprehension. In other words, these patients do suffer from some form of receptive agrammatism. However, we must also stress that the selective vulnerability of morphology observed in this study occurred for *both* fluent and nonfluent patients. Furthermore, the degree of morphological impairment observed was a direct function of the strength of agreement morphology as a cue to meaning in each of the three languages.

Taken together, these three studies present evidence for strong qualitative and quantitative differences among aphasic patients from these three language groups, differences that preserve known structural and functional distinctions among English, German, and Italian. In the present study, which completes the series, we will focus on cross-linguistic similarities and differences in the preservation of word-order principles.

METHOD

Subjects

Subject selection criteria are always an important aspect of aphasia research, but they are particularly important in a comparative study across patient groups and languages. Suppose, for example, we find a difference between English and Italian Broca's aphasics in the degree to which canonical SVO word order is preserved. Is this a difference in language type, or is it an artifact of different patient selection criteria at the two respective research sites? We have discussed these problems in considerable detail in several published papers (Bates et al., 1987; Bates et al., in press; Wulfeck, in press). The problems are legion, but not insurmountable, if we are sensitive to the fact that the "same" level of severity may take different forms depending on the structural and statistical properties of the target language. For example, the sentence "Wolves eat sheep" involves three words and 4 morphemes in English; an Italian version of the same sentence, "I lupi mangiano le pecore," obligatorily involves five words and either 10 or 14 morphemes depending on how we decide to code the contrasts of gender and number.

Because of space limitations, we must refer readers of the present study to the above papers for a more complete discussion of sampling and matching issues in cross-linguistic

TABLE 2
SUMMARY OF PATIENTS BY LANGUAGE AND PATIENT GROUP

	Broca's		Wernicke's		Controls	
	N	Age range	*N*	Age range	*N*	Age range
English	6	32–60	5	47–71	5	20–50
Italian	10	22–77	9	30–73	8	32–59
German	7	31–61	10	44–74	7	18–35

research. For present purposes, the key point is that patient groups were defined *within* each language, according to their fit to a behavioral and neurological prototype used by neurologists and speech pathologists in that community. Five to ten Broca's and Wernicke's aphasics were selected in each of the three language groups, compared with an equal number of normal controls. A prototypic Broca's aphasic would show reduced fluency and phrase length, and a tendency toward omission of functors—*relative to normals in that language*. A prototypic Wernicke's aphasic would display fluent or hyperfluent expressive language, with an apparently normal melodic line; this fluency would be accompanied by marked word-finding difficulties, semantic paraphasias, and perhaps paragrammatisms, together with clinical evidence of an impairment in language comprehension. Here too the judgment is relative to normals in that language. Hence patients are matched across languages only in the sense that they represent degree of deviation from a prototype developed out of observed variation within each language group. This permits us, for example, to compare the "best" patients and the "worst" patients across languages, as well as those who fit the mean. The logic of these comparisons is quite similar to the logic behind percentile scores, although we do not yet have a sufficiently large number of patients in any category to permit percentile scoring.

Patients were referred to us for testing by neurologists and speech pathologists at the three respective research sites, with diagnoses of Broca's aphasia or Wernicke's aphasia (in accord with the above definitions, discussed in a more extended form in Bates et al., 1987; Bates et al., in press; and Bates & Wulfeck, in press). In support of each diagnosis, we were provided with neurological records (including CT scans in many cases), together with the results of standard aphasia batteries used at the respective research sites: the Boston Diagnostic Aphasia Examination in the United States (Goodglass & Kaplan, 1983), the Aachen Aphasia Battery in Berlin (Huber, Poeck, Weniger, & Willmes, 1983), and a battery of tests similar to the Boston Exam that are used in Rome. To eliminate the possibility that a patient had changed status since the diagnosis provided at referral, patients were all screened in a biographical interview administered prior to testing. In addition, we eliminated all patients with one or more of the following conditions:

1. History of multiple strokes
2. Significant hearing and/or visual disabilities
3. Severe gross motor disabilities
4. Severe motor–speech involvement such that less than 50% of subject's speech attempts were intelligible.
5. Evidence that subject was neurologically or physically unstable and/or less than 3 months postonset.

Table 2 summarizes the final sample of patients and controls in each of the three languages. The majority of the aphasias were due to cardiovascular accidents in all language and patient groups. Exceptions included 1 of the 11 English patients (a Broca's aphasic suffering from trauma), 3 of the 19 Italians, and 3 of the 17 German patients. In analyses

TABLE 3
GIVEN/NEW STIMULI

Series	Structure[a]	Sentence
1	AV	A (bear, mouse, bunny) is crying.
2	AV	A boy is (running, swimming, skiing).
3	AVO	A (monkey, squirrel, bunny) is eating a banana.
4	AVO	A boy is (kissing, hugging, kicking) a dog.
5	AVO	A girl is eating an (apple, doughnut, ice cream).
6[b]	AVL	A dog is (in, on, under) a car.
7	AVL	A cat is on a (table, bed, chair).
8	AVOD	A lady is giving a (present, truck, mouse) to a girl.
9	AVOD	A cat is giving a flower to a (boy, bunny, dog).

Note. Legend: A, Agent; V, Verb; O, Object; L, Location; D, Dative.
[a] The element in boldface type is the one that varies.
[b] In structure 6 the varying element is the predicate embodied by the preposition.

of individual patient data, those patients with exceptional medical histories did not show any obvious deviations from the group patterns described below. A similar range of age, educational level, and occupation is also represented in each of the three languages.

All of the Italian patients were right-handed. However, we did include one case of crossed aphasia, a right-handed individual who presented with classic symptoms of Broca's aphasia after a unilateral right-hemisphere insult. Handedness information was unavailable for three of the German patients (one Broca and two Wernicke's); the remaining German patients were all right-handed. In the English sample, all the patients were right-handed except for one left-handed Broca's aphasic. (We should point out that "true" handedness is difficult to determine among older European adults, because left-handedness has been actively discouraged by parents and educators until quite recently).

The only noteworthy difference, other than native language itself, revolves around sex composition. The English patients were all males, residents or outpatients at U.S. Veterans' Administration hospitals. By contrast, 7 of the 19 Italian patients and 10 of the 17 Germans were female. In previous research on language differences in normal speakers, MacWhinney and Bates (1978) did not find differences associated with sex. And in the results reported below, there is also no evidence for a sex difference within either the German or the Italian populations. Insofar as the language differences obtained for aphasic patients correspond to the patterns shown by normals in previous research, there is little reason to believe that a sex difference could be responsible for the results.

Procedure

There were nine picture triplets in all, presented to each subject in an individually randomized order. The order of presentation of individual pictures was also randomized within each triplet. Table 3 summarizes the content of the nine cartoon sets.

Patients were tested individually by experimenters who were native speakers of the patient's language. After an initial warm-up period, the picture stimuli were introduced with the following instructions: "I am going to show you some pictures. I would like you to describe what you see in each picture."

If a patient experienced difficulty getting started in describing one or more of the items, we provided very general prompts like "Can you tell me anything more?" or "What else do you see, what else is happening here?" No other prompts were used, to avoid changing the pragmatic focus conditions provided by the picture sets.

All responses were tape-recorded and transcribed by native speakers, using standard orthography for that language. False starts, repetitions, and extraneous comments were all included in the transcription, to give a faithful picture of the problems that the patient experienced in the task.

Data Reduction and Analyses

For the syntactic analyses, we first went through the transcripts and eliminated all false starts, repetitions, circumlocutionary remarks (e.g., "I know what that is but I can't say it"), and extraneous comments. Hence analyses of word order and syntactic complexity were restricted to the "core description" of each picture provided by the patient. The following example illustrates the procedure that we used to locate this descriptive core; material excluded from the syntactic analysis is indicated in brackets:

[What is that? Ice cream? No . . . Girl . . .] Girl is eat ice cream.

Restricting ourselves only to the descriptive core, we analyzed the absolute number of main and subordinate clauses produced by each patient and control. These figures were entered into a 3 × 3 × 2 analysis of variance, with Language and Patient group as between subject variables, and the main/subordinate contrast as a within-subject variable.

By focusing only on the syntax produced in direct response to the semantic and pragmatic constraints of the stimuli, we were able to code the word-order data entirely in terms of content words referring to depicted elements. We did not infer intended syntactic roles from the morphological elements produced by the patient. Hence in the above example the word order used in the core description would be coded as Agent-Verb-Object (AVO). If the same patient had instead produced these elements with passive word order and morphology, as in "Ice cream was eaten by girl," we would code that utterance with reference to the depicted roles as Object-Verb-Agent (OVA). In other words, our coding of constituent ordering referred to the *order of thematic roles as displayed in the pictures* and not to surface syntax as determined by morphological marking. (Strictly speaking, the term "Agent" is not entirely correct for the experiencer roles depicted in intransitive and locative items, but we will use a single term to avoid proliferating abbreviations across the results section. As we shall see, results were quite comparable for transitive, intransitive, and locative stimuli.)

This role-based coding procedure means that any observed deviations from canonical word order cannot and should not be viewed a priori as word-order errors. We are focusing here on the statistical preservation of different word-order types as a function of language and neurological status. "Good" versus "bad" deviations from canonical order can only be distinguished by returning to the transcripts.

We were interested in the predominance of full three-element word-order types, emphasizing the contrast between canonical and noncanonical structures (e.g., AVO versus OVA, AOV, OAV, VOA, VAO). For each patient, for each core picture description (three pictures per three-item cartoon), we classified all three-element constructions into canonical AVO vs. alternative orders. This analysis was carried out on all transitive items (including both the AVO items and the two dative AVOD sequences): it did not apply to intransitives (AV) or locatives (Agent-Preposition-Location or APL). The maximum score possible would thus be 15 (five transitive cartoons with three pictures each). Since patients varied in the total number of three-element strings that they produced, the tendency toward canonical word order was operationalized as a proportion score: number of canonical strings divided by the total number of three-element strings produced (AVO/(AVO + OVA + AOV + OAV + VAO + VOA)). If word order were random, then this proportion score should average 17% (or 1/6). These proportion scores were entered into a 3 (language) × 3 (Broca's, Wernicke's, and normals) analysis of variance.

Other possible orderings among these three constituents were also informative, capturing cases of partial ordering when key constituents were not mentioned at all. So, for all

transitive and intransitive items (seven items excluding the two locatives) we calculated all instances in which the patient mentioned both the actor and the predicate in a two-element construction (whether or not the object was mentioned). Counting AV orders as canonical and VA orders as noncanonical, proportion scores were calculated according to the formula AV/(AV + VA). Similarly, for the transitive items only we considered all cases in which both the predicate and the object were mentioned (whether or not an actor mention occurred as well). Counting VO orders as canonical and OV as noncanonical, scores were calculated according to the formula VO/(VO + OV). The respective AV and VO proportions permit a chance baseline of 50% if ordering were random. These two scores were also entered into two separate 3 × 3 (Language by Patient Group) analyses of variance.

A fourth analysis focused on the relative ordering of Agent and Object, if both were mentioned, regardless of the presence or absence of a verb. Here too, chance probabilities were 50% in a calculation of AO/(AO + OA). These ratios were also analyzed in a Language by Patient Group design.

We carried out separate analyses on the two locative items (APL). First, proportion scores were constructed for all utterances mentioning all three target elements, as follows: APL/(APL + ALP + PAL + PLA + LAP + LPA). These were analyzed in the same way as the AVO contrasts discussed above. We also conducted analyses on all utterances mentioning the Agent and Preposition, and Preposition and Location, regardless of the presence or absence of the third element. These proportion scores were constructed according to the following two formulae: AP/(AP + PA) and PL/(PL + LP).

Performance on the two dative items requires separate, more qualitative discussion. There are far more options in all three languages for the ordering of these constituents, compared with the other comparisons described above. Just a few examples in English would include "The mother is giving a mouse to the girl"; "The mother is giving the girl a mouse"; "The girl is getting a mouse from the mother"; "The mother has a mouse and the girl takes the mouse"; and so forth. There is no simple way to quantify "canonical" vs. "noncanonical" within a set like this. But we will discuss the extent to which patients and controls made use of the more common Agent-Verb-Object-Dative (AVOD) and Agent-Verb-Dative-Object (AVDO) orders in their respective languages.

Some additional analyses in Italian involved word-order variations in the biographic interviews. These will be described in more detail later, but they are essentially replicates of the AVO analyses described here for the given–new transcripts.

RESULTS AND DISCUSSION

The results will be presented in three sections:

(1) Production of main versus subordinate clauses in the given–new task

(2) Analyses of canonical and noncanonical word order in the given–new task

(3) Comparisons of word-order variation for Italian subjects in the given–new task and the biographical interviews.

Main and Subordinate Clauses

Our analysis of main and subordinate clauses produced main effects of group $F(2, 58) = 4.20$, $p < .05$, and clause type $F(1, 58) = 177.83$, $p < .001$. The group effect reflects the unsurprising finding that Broca's aphasics as a group produced fewer clauses overall (8.95) than either

controls (12.15) or Wernicke's aphasics (11.9). The effect of clause reflects the equally unsurprising fact that all subjects produce more main clauses (averaging 17.8 per subject) than subordinates (averaging 4.10). There was no main effect of language, meaning that English, German, and Italian subjects in this structured picture-description task produce roughly the same number of clauses overall.

More interesting information comes from two interactions involving the clause-type variable: language by clause type $F(2, 58) = 17.38$, $p < .001$, and group by clause type $F(2, 58) = 5.71$, $p < .01$. The language by clause type effect replicates a finding reported elsewhere by Bates and Devescovi (in press), demonstrating that normal Italian adults and children produce far more relative clauses than their English-speaking counterparts when describing the same picture stimuli, including the given-new materials (see Bates & Devescovi for a discussion of the functional differences between Italian and English that are responsible for this effect). The patient group by clause type interaction reflects the fact that Broca's as a group produce proportionally fewer complex structures (averaging 16.78 main clauses and 1.13 subordinates) compared with Wernicke's (20.04 main, 3.75 subordinates), who in turn produce a smaller proportion of complex constructions than normals (16.35 main, 7.95 subordinates). The three-way interaction did not reach significance $F(4, 58) = 1.66$, $p < .17$. Hence we can conclude that a proportionate reduction in subordinate forms is a characteristic of both fluent and nonfluent aphasics in all three languages (although, interestingly, 4 of the 10 Italian Broca's did manage to produce some relative clause structures).

With regard to the general question of syntactic deficits in aphasia, we have established that reductions in phrase structure complexity occur in all three languages, for both fluent and nonfluent patients—although the reduction is clearly more severe for Broca's aphasics. This replicates many other findings in the literature, and serves primarily to demonstrate that our definitions of the two patient groups are roughly similar over languages. We can now turn to the question of word-order preservation.

Canonical and Noncanonical Orders in the Given–New Task

Appendix 1 lists individual patient data for all the word-order analyses. As a rough estimate of severity, patients are rank-ordered within each group to reflect the proportion of function words produced in the given–new transcripts (taken from Bates et al., in press).

The first analysis of variance was conducted on the proportion of three-element transitive descriptions that were uttered in the canonical AVO order. The results can be summarized easily: there were no main effects of either Language or Patient Group, and no interaction. In other words, aphasics and normals did not differ in their use of canonical word order.

Nor did we find the expected difference in word order as a function of language. Although the trend was in the direction of more word-order variation by Italian and German speakers (see Appendix 1), the difference was not reliable.

The lack of language or patient group effects should *not* be taken to mean that these are null findings. Rather, we have strong positive evidence for preservation of canonical AVO word order, in all three languages. AVO order was used 81% of the time—compared with a chance level of 17%. These proportions represent an average of 8.77 complete AVO constructions, compared with 1.02 alternative orders for the same three elements. To clarify this point, we reanalyzed the same data treating raw number of constructions as the dependent variable, adding the contrast between AVO and alternative orders as a factor in the design. This permits us to make a direct test of the difference between the number of canonical word orders (8.77 per patient) and the number of alternative orderings for the same three elements (1.02 per patient). When the data are analyzed this way, we find a massive main effect of word-order type, but no effects of language or patient group and no interactions. In other words, the two analyses (proportions versus raw scores) tell us precisely the same thing. For purposes of economy (and because proportion scores are more appropriate), we will restrict ourselves to the proportional analyses from this point on.

The two respective two-element analyses also yielded strong evidence for preservation of canonical SVO word order, although there were at least a few hints of language and patient group differences in syntactic planning. AV constructions averaged 91% compared with a chance baseline of 50% if constituents were ordered randomly. The raw scores behind these proportions are even more striking: an average of 14.23 AV orderings compared with 1.1 alternative VA utterances. However, the analysis of variance did reveal a trend toward a Language difference $F(2, 58) = 2.99$, $p < .06$, and a significant Language $\times$ Patient Group interaction $F(4, 58) = 4.55$, $p < .01$. This interaction comes from a tendency for German controls to produce more noncanonical VA constructions. The VA construction in German is a stylistic device that is particularly likely to occur in narratives, roughly similar to English sentences like "In came the rabbit." German Broca's and Wernicke's aphasics are apparently making much less use of this stylistic option. They are, instead, much *more* likely than controls to stick with a canonical Agent-Verb ordering.

On the VO analysis, we also found strong evidence for preservation of canonical word order, averaging 89% against a chance baseline of 50% (with an average of 10.50 VO constructions for each speaker, compared with .74 OV utterances). There is a trend toward a language difference $F(2, 58) = 2.76$, $p < .07$, with Italians producing a slightly larger proportion of OV constructions (18%, compared with 10% in English and 5% in

German). In addition, we obtained our only significant main effect of patient group $F(2, 58) = 3.70$, $p < .05$. Across languages, Broca's were significantly more likely to produce noncanonical OV constructions (20%), compared with 9% for Wernicke's and 5% for controls.

Does this mean that we finally have evidence for syntactic breakdown in aphasia? A detailed examination of the transcripts showed that many of the OV constructions were indeed coming from the least fluent and most impaired Broca's aphasics within each language (see Appendix 1). However, it would not be appropriate to call these utterances "word-order errors." Instead, they seem to occur when the patient has abandoned efforts to plan an integrated utterance, trying instead simply to name various aspects of the picture. A typical example from English is the following:

Banana . . . three . . . eat . . . [I don't know].

On the next item, this same patient produced a series of three morphologically flawed but syntactically correct utterances:

Boy is hugging
Boy kissing the dog.
Boy hitting the dog.

In other words, when the patient did try to stage a complete transitive description, he produced all the major constitutents in their canonical position. This pattern is typical of all of our Broca's aphasics, even the most seriously impaired.

On the two-element AO analyses, we again found a very strong bias toward canonical order (93%), with no significant effects of either language or patient group. Hence, even if we disregard the position or presence of the verb, patients seem to show biases quite similar to those displayed by normals in the ordering of agents and objects.

On the Agent-Preposition-Location analysis (APL), we also found a strong tendency for all languages and patient groups to preserve canonical order: an average of 70% canonical APL order, against a chance baseline of 17%. The analysis of variance revealed no differences as a function of either language or patient group, and no interaction—exactly like the AVO analysis presented earlier. The same thing was true for analyses of the two-element combinations: an overall bias of 84% AP orders and 82% PL orders across languages and patient groups, with no main effects or interactions in either analysis. Note that our Broca's aphasics do, as we might expect, omit prepositions more often than either normal or Wernicke's aphasics (Bates et al., in press). However, these analyses show that agrammatic Broca's aphasics do understand the positional principles that govern use of prepositions when they are produced.

Overall, then, our results provide strong evidence for preservation of canonical word order in aphasia, at least with these stimuli. This does not mean that aphasics and normals produced exactly the same kinds

of syntactic constructions. Complex constructions were rare, and omissions and substitutions of inflections and function words were common in the two aphasic groups (as discussed in detail by Bates et al., in press). The patients' constructions often seemed fragmented, with a large number of pauses and interruptions. The least-fluent patients occasionally abandoned all efforts to stage a complete utterance, and fell back on a strategy of naming separate in the picture. Despite these problems, our patients were clearly aiming at a common phrase structure target: a canonical Agent-Verb-Object order that corresponds to the basic SVO phrase structure in English, German and Italian. They were also able to order Agents, Prepositions, and Locations correctly on the two locative items.

On the more complex dative items, a somewhat different picture emerges. Because there were only two dative items (one focusing on the changing dative, the other focusing on a changing object), there were only six opportunities for each patient to mount a complete dative construction. In fact, both normals and patients produced far fewer than six complete constructions on the average: the overall means were 1.46 AVOD utterances, 1.11 AVDO utterances, and .66 examples of a four-element utterance in some other order. On these two dative cartoons, normal speakers (and many patients) often produced synthetic, elliptical descriptions like "A mother is giving her daughter a mouse, a truck and a box," or a series of linked constructions like "The mother gives the girl a mouse. . . . This time she gives a truck. . . . and here a box." This means, of course, that our analyses of order preference for the dative items rest on very few examples—and for that reason, they must be interpreted with caution. They do, however, suggest some interesting interactions between sentence planning and sentence complexity.

We carried out an analysis of variance on the mean number of AVOD, AVDO, and Other four-element constructions produced by each patient and/or control, in a Language (3) by Group (3) by Construction (3) design. There was a main effect of Construction type $F(2, 116) = 5.36$, $p < .01$, reflecting the predominance of the two most common order types over language and patient groups (AVOD = 1.46 per speaker; AVDO = 1.11; alternative orders = .66). There was also an interaction of Language × Construction $F(4, 116) = 3.09$, $p < .05$, reflecting known facts about preferred order in these three languages: English speakers showed roughly equally preferences overall for both AVOD and AVDO (reflecting the fact that dative shifting is quite productive in English), Italian speakers showed a clear preference for AVOD (the least marked and most common form of the dative in that language regardless of focus conditions), and Germans demonstrated a bias toward AVDO (the least marked and most common order in German if object and dative are both expressed as a full noun phrase).

The most important finding for our purposes was a Language × Group

TABLE 4
MEAN NUMBER OF DATIVE ITEMS PRODUCED BY EACH GROUP

Group	AVOD	AVDO	Other
Normals			
English	1.60	3.40	.00
German	.29	1.71	.29
Italian	3.25	.38	.63
Broca's			
English	1.50	.17	.17
German	1.57	.57	.29
Italian	1.60	.90	.70
Wernicke's			
English	1.60	.80	1.60
German	.60	1.80	.60
Italian	1.33	.78	1.44

× Construction interaction $F(8, 116) = 2.67$, $p < .01$. As can be seen from Table 4, normals in all three languages are primarily responsible for the language-specific patterns we just described: heavy use of dative shifting in English (with 3.4 AVDO constructions and 1.6 AVOD, compared with no alternative orders whatsoever), a very marked preference for AVOD in Italian (3.25, compared with less than one example per speaker in the other two categories), and a strong preference for AVDO in German (1.71, compared with an average of .29 in both of the other categories). By contrast, Broca's aphasics in all three languages seemed to show a preference for the AVOD construction, while Wernicke's aphasics in all three languages were remarkable more than anything for their *lack* of consistency.

The lack of consistency in Wernicke's aphasics is compatible with the results presented by Bates et al. (1983), who focused only on our English patients. In all three languages, the fluent patients are all experiencing moderate to severe word-finding difficulties. An examination of their transcripts shows that these lexical problems influence their syntactic planning. They attack the complex dative descriptions by starting on a "first come, first serve" basis. That is, they start by lexicalizing whatever they can find, and then bludgeon ahead trying to make the sentence come out right. Sometimes they lexicalize the dative first, and then derail in their efforts to locate the appropriate verb. More often, they do manage to begin with the agent, but they often follow with the wrong verb (e.g., "gets"; "holds"; "has"; instead of "gives"), which in turn makes it difficult for them to complete a well-formed dative-object or object-dative sequence. In other words, at least on the more complex constructions,

Wernicke's aphasics do demonstrate a word-order problem. But that problem seems to be tied inextricably to their lexical impairment.

The performance of Broca's aphasics presents a rather different picture. In English and Italian, the apparent preference for AVOD order can be explained as another example of a canonical "safe harbor" strategy. In both these languages, AVOD is generally considered to be the pragmatically neutral or "default" order (e.g., "John gave the book to Mary"). Object-final constructions are very common in English, but they tend to reflect situations in which the pragmatic focus falls on the object (e.g., "John gave Mary the book"). To examine whether this focus principle was operating in our data, we separated the performance of English speakers on the two different dative items. For both aphasic and normals speakers (though the tendency is much more marked for normals), it was indeed the case that more DO orders occurred on the cartoon where three different objects are given, while more OD orders occurred on the cartoon where the same agent gives the same recipient three different objects. English Broca's are less likely to obey this principle, but their constructions are nevertheless quite lawful in most cases. And in Italian, the AVOD bias is even more appropriate.

By contrast, the behavior of German Broca's aphasics has to be regarded as deviant. If all the elements are expressed as full noun phrases, then the default word order should be AVDO. An AVOD order "sounds right" only if (1) the object is pronominalized, or (2) the dative is postposed together with a strongly marked preposition (roughly equivalent in meaning to "The mother gave a mouse, and it was to the girl"). We examined each of the datives produced by our German patients, and found that their AVOD constructions did not meet these qualifications. As such, they could in fact be considered word-order errors. That is, the German patients may have lost sensitivity to dative position constraints in their language.

There is, however, another interpretation. In most of the instances in which a German Broca's aphasics placed the dative in final position, s/he also produced a case error. The dative case is less frequent and demonstrably more difficult for these patients than the accusative, which is in turn more difficult (i.e., more prone to error) than the nominative (Bates et al., in press). Perhaps our German patients were *postponing* the arrival of a difficult dative case retrieval, and as a result they ended up committing an error of *postposing* as well.

According to this interpretation, English and Italian Broca's aphasics would produce a larger number of AVOD constructions because they are clinging to canonical word order as a "safe harbor." German patients might do the same, except that the canonical AVDO in German forces them to confront a dative retrieval earlier in sentence planning. So they produce a somewhat larger number of marked and inappropriate word

orders in an effort to postpone their hardest problem. This explanation has the advantage of taking into account the different morphological problems posed by German vs. English and Italian. But it is also less parsimonious overall. A third explanation could unify the data for Broca's aphasics in all three languages: nonfluent patients prefer AVOD orders on the complex dative constructions because they are trying to preserve the phrase structure unit that is easiest for them to produce, i.e., canonical AVO.

For the moment, we think it wiser not to choose from among these alternatives. There are too few dative items in our battery to bear strong conclusions. Furthermore, a subset of the Broca's aphasics in each language made no contributions to this set at all (i.e., three English, three Italian, and two German patients produced no four-element constructions). However, compared with the overwhelming evidence for presevation of canonical word order in other sentence types, the dative results suggest that there are interactions between complexity and planning that need further investigation.

Biographical Interviews

We were actually surprised that there were not more differences between the three languages in the amount of word-order variation demonstrated in the given-new experiment—at least for normal speakers. We know that Italians do engage in much more pragmatic variation in their informal speech; the same is true (albeit to a lesser extent) for Germans. However, the static picture description task that we used here seemed to put all of our speakers (both normals and aphasics) into a rigid mode of descriptive discourse. For purposes of comparison, we decided to examine the biographical interview data, to see whether this more informal situation "releases" word-order variation.

The interviews were all conducted around a standard set of themes: the patient's job history, medical history, family, hobbies. They were carried out in an informal conversational mode as a "warm-up" prior to the first of our experimental sessions. In English and German the interviews were used as a screening device, but most were not transcribed or analyzed further. In Italian, we had complete transcriptions available on interviews with all patients and controls.

We coded the Italian interviews in a form that closely approximated the above word-order analyses for the given new task: the same proportions were derived for AVO structures (AVO/AVO+OTHER), and for two-element AV and VO constructions. We focused only on the kinds of simple transitive and intransitive clauses that made up our given–new sample, leaving out more complex complementizing constructions and/or the multitude of vague and formulaic constructions that occur throughout informal discourse (e.g., "I didn't know that" would not be included in

the sample for word-order analysis). In other words, the two samples (i.e., given–new vs. biography) were kept as comparable as possible. There were still inevitable differences—particularly the larger proportion of first- and second-person reference that occurs in the interview setting.

To offer some idea of the range of word-order variation that is likely in Italian discourse, Table 5 compares the results for the given–new and the interview with an independent sample of parental speech to children analyzed by Bates (1976). The results are similar in most respects, except that the adult–child sample contains a much higher proportion of VA constructions. This reflects two facts about caretaker speech: the heavy use of questions (which typically, though not obligatorily, occur in a VA order in Italian) and the preponderance of emphatic forms (e.g., "Lo faccio *io*"—"It will do *I*"). But the caretaker samples also illustrate a more general fact about pragmatic variations of word order in Italian: noncanonical VA constructions are more frequent, and more broadly distributed, than noncanonical OV constructions. These facts are reflected in the performance of Italian aphasic patients.

The three respective proportions scores (AVO, AV, and VO) were each entered into a 3 × 2 analysis of variance, with three levels of Patient Group (Broca's, Wernicke's and normals) and two levels of text type (Given–New, Biographical Interview).

There were no differences of either text type or group in the full AVO analysis. This replicates and extends the results described earlier: both fluent and nonfluent patients retain normal levels of canonical word-order use in their language (in this case, Italian). In full transitive items, canonical word order still predominates for patients and normals alike (see Table 5, for comparable results).

Results were similar for the VO analysis, with no main effects of either Group or Text, and no significant interaction. All subjects showed an overwhelming preference for canonical VO, in both texts: 84% VO structures in the biographical interview, 83% in the given–new. Recall that Broca's aphasics did produce significantly fewer VO structures in our analyses of the given–new results. That patient group difference disappeared when we consider results for interviews and picture description together. Broca's aphasics actually *increased* their use of VO from the given–new to the biographical interview, reaching an 83% level of VO ordering that is indistinguishable from the other two groups. Looking at the transcripts, we suggested earlier that cases of apparent word-order deviation among Broca's aphasics in the given–new actually reflected instances in which the patient completely abandoned efforts to stage a complete clause; the very same patients did follow canonical order when they managed to put together a connected utterance. In the less formal biographical interview, the patient is more at ease and there are no "confrontation items" to be described. Under these conditions Broca's aphasics are

TABLE 5
PERCENTAGE USE OF VARIOUS WORD ORDERS IN ITALIAN

Group	AV	VA	VO	OV	AVO	OVA	AOV	OVA	VAO	VOA	Total others
Parental speech to children[a]	48.3	52.7	89.7	10.3	81.2	4.5	2.3	0	11	4	18.8
Broca's	85.82	14.18	82.70	17.30	88.33	0	0	11.67	0	0	11.67
Wernicke's	76.22	23.78	85.84	14.16	86.47	4.5	0	4.8	0	4.2	13.5
Controls	79.20	20.80	83.94	16.06	79.17	6.25	14.5	0	0	0	20.83
Free speech total for patients and controls	80.29	19.71	84.19	15.81	85.47	3.5	4.8	5.4	0	1.3	15.0
Broca's	89.58	10.42	68.84	17.18	97.37	—	—	—	—	—	2.63
Wernicke's	90.17	9.83	90.63	9.37	75.54	—	—	—	—	—	24.46
Controls	98.81	1.19	92.06	7.94	86.19	—	—	—	—	—	13.81
Given–new total for patients and controls	92.50	7.50	82.82	17.18	85.18	—	—	—	—	—	14.82

[a] The differences between parental speech to children and aphasic interviews is due primarily to the high proportion of questions (which are statistically though not obligatory VS and VSO and emphatic forms in the parental protocols).

apparently better able to stage a complete utterance—returining to the safe harbor of canonical VO order.

Yet another pattern is revealed in the AV analysis. Here we obtained a significant effect of Text $F(1, 21) = 6.91$, $p < .016$, but no effects involving Patient Group. Italians as a group produced fewer canonical AV constructions in the free speech situation (80%) than in the given–new task (92.5%). This tendency was observed for Broca's aphasics (86% vs. 90%), Wernicke's aphasics (76% vs. 90%), and normals (79% vs. 99%). As can be seen in Table 5, right-dislocations of the subject (VA) are more common than left-dislocations of the object (OV). This greater "motility" of the subject seems to be reflected in the performance of Italian speakers in the biographical interview.

Can we be sure that the VA constructions by nonfluent patients represent well-formed pragmatic variations? We went back to the interview transcripts for Italian Broca's aphasics and reviewed each instance of a noncanonical VA ordering. Five of the patients produced no such orderings at all. But for the positive cases, results were quite clear: each use of VA represented a well-formed word-order variation in Italian. This was true even when the patient made morphological errors within the same construction. For example, one patient responded to a question about the weekend performance of his favorite soccer teams by saying "Ha vinto tutte e due" ("Has-3rd/Singular won both-3rd/Plural). This VA word order constitutes an appropriately emphatic and happy response by a sports fan, despite a clear error in subject-verb agreement. Although the number of instances is small, we feel confident in concluding that these patients retain the ability to produce appropriate pragmatic variations in subject-verb ordering.

These analyses have amplified the earlier results in two ways: we have still more evidence for the preservation of canoncial word order in aphasia (at least in this language, in these two situations), and we have learned that patients can retain the ability to make use of stylistic variations if those variations are particularly frequent and accessible in their language.

GENERAL DISCUSSION

If the closed-class hypothesis were correct, then grammatical morphology should be affected in aphasia regardless of the patient's native language, while word order ought to be retained at normal levels (at least within simple sentences). By contrast, if a strong version of the competition model applies to grammatical processing in aphasia, then the effects of brain damage should apply primarily to the "weak link in the chain": grammatical morphology in a strong word-order language like English; basic word order in languages like Italian and German where morphology is the most important tool for the expression of meaning. Our findings suggest that the closed-class hypothesis withstands this strong cross-linguistic test. Even in languages with relatively "free" or variable order

patterns, there is no evidence that patients have lost control over canonical word order in simple sentences.

With regard to noncanonical word-order types, the given–new task did not elicit the range of pragmatic word-order variations that we expected. Instead, normal and aphasic speakers of all three languages stuck with basic SVO order for virtually all their picture descriptions. This led us to compare the picture task with free speech samples in Italian, to see if there is a marked increase in the kind of word-order variation that is typical for that language. Even under more natural discourse conditions, deviations form a full SVO were rare. Broca's aphasics actually *increased* their use of canonical VO in the interview situation, compared with the picture-description task (where they more often abandoned any effort to stage a complete connected clause). The most common form of word-order variation in Italian is right-dislocation of the subject. These VA variations were indeed "released" by the free speech situation, for aphasics and for normal controls. We can conclude that *both* canonical and noncanonical word-order patterns are preserved in aphasia, at least for simple sentence structures. But the patient's ability to use alternative orders, and the extent to which he clings to canonical structure, seem to interact with task demands and with other aspects of sentence complexity.

In fact, phrase structure planning is not completely normal in either the fluent or the nonfluent aphasics. First, both patient groups used significantly fewer subordinate structures than normals in their language. Second, although we had too few dative items to support strong conclusions, results do suggest that there are interactions between sentence complexity and sentence planning. Wernicke's aphasics were quite inconsistent in their word-order planning on these items, apparently derailed by word retrieval problems. Broca's aphasics clung to one particular order: AVOD. In Italian and English, this seems to be another version of a general "safe harbor" approach to syntax, i.e., a preference for the least marked and most neutral word order. But in German, this AVOD bias actually runs against canonical word order in the language. We considered three somewhat different explanations for this pattern, and cannot choose among them on the basis of our small sample of dative utterances. In general, however, the findings provide evidence for syntactic conservatism among nonfluent patients: a tendency to preserve canonical word order in Broca's aphasia, even if that "safe harbor" strategy leads to an inappropriate (albeit well-formed) word-order choice.

This is also consonant with our findings on pragmatic word-order variation. In the given–new task, German aphasics (both fluent and nonfluent) failed to use the stylistic Verb-Agent ordering that occurred so frequently for German controls. In the less-structured, less-formal biographical interviews, some Italian patients did use the VA variant, while at the same time increasing their use of canonical VO over the levels displayed in

the given–new task. What we seem to have here is an interaction between preserved syntactic knowledge and performance limitations of some kind, creating in a U-shaped function in the use of noncanonical forms. In most situations, the nonfluent patient clings to the most frequent and accessible phrase structures—to the point where he may seem to overuse canonical form relative to normals in his language. At the high-stress end of the continuum, if the patient is completely overwhelmed by lexical access problems (or some other processing difficulty), he may abandon efforts to stage a complete utterance—resulting in apparent deviations from canonical order. At the other end of the curve, under conditions that place minimal demands on retrieval and planning (e.g., in an informal conversation about an easy topic), we may again find deviations from canonical form—this time in directions that are lawful and appropriate according to the principles of pragmatic word-order variation in the patient's language (see also Kolk & van Grunsven, 1985). Taken together, these results suggest that knowledge of ordering principles is preserved, but the patient is affected in his ability to *access* more marked and/or infrequent structures.

Some investigators have suggested that preservation of canonical word order should be regarded as a *nonlinguistic* strategy, an adaptation to the aphasic condition (Caplan, 1983; Caplan & Futter, 1986; Schwartz, Saffran, & Marin, 1980). The strategy may be derived from structural facts in the patient's native language, but the processes involved are not the same ones used by a normal speaker. For example, patients who were native speakers of an SVO language may have a strategy that can be paraphrased as "Start your sentence with the agent of an action whenever possible." This leads to apparently correct structures in many cases, but also leads to errors of role assignment (e.g., when the situation requires something like "The ball hit the boy"). As noted by Kolk and van Grunsven (1985), the problem with this interpretation is that there is no clear a priori way to distinguish between nonlinguistic heuristics and "real" principles of sentence planning. How much evidence do we have to have for phrase-structure preservation before we are willing to impute normal processes and structures to the brain-damaged speaker? For example, in our study the preservation of canonical word order was not restricted only to the AVO unit, since we also had very good evidence for preservation of ordering around a locative preposition. And the tendency for some of our Italian patients to retain use of VA orders in the biographical interview shows that noncanonical word order may also be preserved under certain circumstances.

Evidence from other languages also suggests that the preservation of word order is a general phenomenon. The results presented here pertain only to languages with a default or pragmatically neutral Subject-Verb-Object order. The three languages are also similar in the way they stage

locative constructions: Agent/Object-Preposition-Location. Other members of our cross-linguistic team have been examining the use of positional information in languages with different basic word-order properties. They have administered the given–new task to three Turkish Broca's aphasics (A. Talay and D. Slobin, personal communication, May, 1986), three Hungarian Broca's aphasics (J. Osman-Szagy and B. MacWhinney, personal communication, May, 1986), and four Broca's aphasics who were native speakers of either the Mandarin or Taiwanese dialects of Chinese (O. Tzeng, personal communication, May, 1986). The results are still preliminary, but so far they are very clear.

In Turkish, the pragmatically neutral or default order of constituents is SOV, although extensive variation does occur. SOV is the predominant pattern used by normals in the given–new task, and it is also the most frequent order used by Broca's aphasics. These patients used a complete SOV order in 90% of the utterances containing all three sentential elements (an order that would occur only 17% of the time if sequencing were random). Furthermore, out of 72 utterances with both a subject and verb (including the intransitive items), 70 utterances or 97% placed the subject in preverbal position. Hence Turkish Broca's aphasics not only retain preservation of canonical SOV word order, they also show a "syntactic conservatism" in the use of this order that is unusual in their language.

Hungarian is usually described as an SOV language. However, the situation is actually much more complex. Definiteness of the object is marked on the verb and helps to determine the preferred sentence order. If the object is definite, the statistically preferred order is SVO; if the object of the verb is indefinite, then the predominant order is SOV. These orders are best regarded as a statistical summary, rather than as a set of hard-and-fast rules. The single most reliable predictor of word order in Hungarian is based on pragmatic rather than syntactic principles: the position just before the verb is reserved for the sentence focus, i.e., the most important or informative constituent relative to the main verb (e.g., MacWhinney et al., 1985).

Analyses of order in the Hungarian given–new transcripts suggest that SOV and SVO are both heavily used by Broca's aphasics, although there is a greater-than-normal preference for SVO. Because these patients produce a large number of morphological errors, the relationship between order and definiteness is difficult to track. In general, however, the SVO/SOV patterns for these patients can be interpreted as a preference for canonical orders, with a slight bias toward the "maximum givenness" SVO frame. In view of the finding that Broca's aphasics have a greater tendency toward definite reference (Bates et al., 1983), this "maximum giveness" tendency in Hungarian is interesting in its own right—and may constitute one more bit of evidence supporting the idea that Broca's aphasics prefer a safe syntactic harbor. But the major finding is that

SOV and SVO are *both* quite common in Hungarian aphasics. Canonical word order is preserved in aphasia—even if the language has two canonical orders instead of one.

Chinese is classified as an SVO language, but it differs from English in several important respects. Subject omission is quite common (Li & Thompson, 1976). Initial position is preferred when the subject is expressed, but several structural variations are possible. Most notably, Chinese permits left-dislocation of the object into topic position—so that OV constructions are actually quite common. These include two structures: S-ba-OV (wherein "ba," a particle that is related to a verb meaning "grasp"; "hold"; or "watch," serves as a kind of emphatic marker) and O-bei-SV (a topicalizing structure that serves as the Chinese equivalent of a passive). Finally, Chinese has postpositional rather than prepositional locatives, so that a picture of a cat on a bed would be described with something like "Cat exists bed-top." Within this framework, the results for Chinese Broca's aphasics are particularly interesting.

First, whenever the Chinese patients used a locative particle, the particle occurred in the obligatory postnominal position. This is the mirror image of the preservation of preposition-location ordering in Indo-European languages, suggesting that aphasics retain language-specific information about locative constructions, whether the language uses prepositions or postpositions.

Second, on both the transitive and intransitive given–new items, these patients did show a bias toward S-initial constructions. This is, again, in keeping with the basic word-order biases of their language. However, the patients produced a roughly equal number of OV and VO constructions—with a slight bias toward object topicalization. We are justified in interpreting the OV utterances as left-dislocations rather than simple word-order errors, because three of the four patients did attempt (and sometimes successfully produce) a complete "S-ba-OV" or a "O-bei-SV" construction—that is, they produced the morphology required for a correct left-dislocated structure. Once again, it appears that nonfluent patients will try to stage more marked or complex syntactic constructions if those structures are particularly frequent and useful in their language. It is interesting that the Chinese patients do engage in so much stylistic variation, in contrast with the findings for English, German, Italian, and Turkish. But the major point is similar to the conclusion for Hungarian: if a language has more than one basic or very frequent word order, then both word orders are likely to appear in the data for aphasic patients.

We conclude that at least three aspects of syntax are selectively preserved in aphasia: basic word order (whether it is SVO, SOV, OSV, or some combination), ordering around locative prepositions or postpositions, and the ability to produce noncanonical word orders if those structures are accessible and appropriate in a given discourse situation. Similar results

are reported by Menn and Obler (in press; Menn, 1985) in a set of intensive case studies of free speech in mild Broca's aphasics, in 11 structurally distinct languages. They do find an avoidance of marked forms—including an avoidance of prenominal adjectives (e.g., "The red dog") even among patients who can produce a predicate adjective (e.g., "The dog is red"). But the picture seems to be one in which basic phrase structure is preserved—and perhaps overused, relative to the more flexible productions evident in normal controls. Given the generality of these findings, across languages that vary widely in their structural preferences, we find it difficult to accept the view that aphasics are "mimicking" normal syntax through a set of ad hoc strategies. Instead, it seems more parsimonious to assume that they have preserved knowledge of syntactic structure—but that structure is sometimes difficult to access or use because of problems from other quarters.

From this point of view, we can perhaps resolve an apparent contradiction between our results and those reported by Saffran et al. (1980) for five Broca's aphasics in a different picture-description task. First of all, Saffran et al. also report that N-V-N orders predominate for their patients, when and if they were able to martial a complete utterance:

> "When patients produced utterances consisting of two nouns and a verb, the basic N-V-N structure seemed to be preserved. There were occasional instances in which a verbal was produced holophrastically, and a few N-N utterances that did not contain a verb, but when a verbal element was produced in the context of a phrase, it invariably followed a noun." (p. 270)

Hence their patients also seem to be "aiming" at a canonical phrase structure. Furthermore, when their patients did produce word order "errors," they also seemed much of the time to have abandoned sentence building for a naming strategy (e.g., ". . . The agrammatic does not use the verb in a relational sense, but rather to "name"the action," p. 278). This is similar to our results for VO and OV constructions, where the same patient who seemed unable to order elements in one disconnected construction (e.g., "Banana . . . three . . . eat") went on to stage a complete series of connected AVO constructions on the next item (e.g., "Boy hugging dog"). We suggest that, overall, the Saffran et al. patients are similar to the most impaired agrammatics in our cross-linguistic sample. A Broca's aphasic may be so badly impaired that he prefers to avoid the effort required to stage a complete utterance. The requisite word-order knowledge is "there," but it is often short-circuited when the patient is tired or the material is particularly difficult.

This tendency may be particularly marked if the patient suffers word-finding problems within the open class; it is hard to get a sentence off the ground when key lexical items cannot be located. This second point

may be responsible for some further discrepancies between our data and that of Saffran et al. Their patients did seem to produce at least a few "true" word-order reversals (e.g., the intended object in preverbal position, and the intended subject in postverbal position); we do not find similar violations in our data. At least some of the difference may reside in the kinds of verbs used in our respective experiments. The transitive actions in our stimuli were all "prototypical transitives," i.e., physical causation initiated voluntarily by the agent, carried out on a relatively passive patient (e.g., kiss, hit, kick, pat, touch). Notice that, even in semantically reversible sentences, the directionality implied by the verb is clear: one and only one of the protagonists could take the subject role in an active declarative sentence. By contrast, many of the verbs depicted in the Saffran et al. stimuli were nonprototypical transitives (e.g., carries, lifts, pulls, chases, follows, runs to, takes a picture of). With these actions, subject assignment could be made from the point of view of either participant, while still preserving an active, declarative S-V-O structure.

X carries Y = Y rides on X
X pulls Y = Y pushes X
X chases Y = Y runs from X
X takes Y's picture = Y poses for X

And so forth. Saffran et al. point out that these perspective shifts are rare in normals, and hence there is no reason to expect them to occur for patients. Perhaps not, but word-finding difficulties are such a notorious part of any aphasic syndrome that we cannot rule out a lexical explanation for at least some of these errors. In a parallel activation model of lexical access (e.g., Marslen-Wilson & Tyler, 1980; McClelland & Rumelhart, 1986), an ambiguous bidirectional event may simultaneously activate both of the relevant verbs. For normals, the incipient competition is usually resolved very rapidly—perhaps well before the conflict comes to consciousness. But this kind of situation may put patients under so much stress that they are derailed in midutterance, aborting a well-formed syntactic plan. Alternatively, they may end up blending two well-formed SVO candidates (e.g., "Boy rides on horse" and "Horse carries boy") into an erroneous albeit well-ordered utterance like "Horse rides on boy" (c.f. Fay, 1980, for evidence of similar sentence-level blend errors in normal speakers).

This notion of a competition between well-formed alternatives reminds us of an introspective report by Monsieur Clement, a French Broca's aphasic studied by Nespoulous et al. (1984):

> "Even though I know perfectly well that it is a preposition or an article (. . .) that I need, several of them come up in my mind and I never know for sure which one to produce."

This impression of parallel competition refers primarily to closed-class

elements. However, given the problems that Broca's aphasics are known to have with main verbs, it is entirely possible that these patients are placed in a similar quandary when faced with bidirectional events that are compatible with several forms of the verb—and hence with at least two perfectly legal but completely opposite phrase structures. As Goodglass and Menn (1985) have pointed out, patients with frontal involvement are particularly likely to suffer from an inability to choose between alternatives—and the longer they wait, the worse it gets. This could occur either in real-time speech production or in sentence reconstruction tasks using words on cards, if the lexical items are sufficiently ambiguous that both OVA and AVO orders seem plausible. In this regard, it would be be useful to have more control data from posterior aphasics within the Saffran et al. paradigm, to disentangle a possible mixture of grammatical and lexical effects.

In short, we think it necessary in syntactic error analyses to distinguish between "true" word order violations, and production of fragments that were never intended to form a sentence—either because a patient is avoiding the hard work of constructing a whole utterance and resorting to a naming strategy (as in the OV constructions by our patients), or because the patient has been derailed in his efforts to stage an utterance by word-finding problems (starting over again in midstream), or because ambiguous stimuli create a competition that the patient resolves by blending legal forms. True word-order violations seem very rare, as Goodglass (1968) concluded many years ago. But "pseudosyntactic" errors may in fact be quite common.

As shown by Bates et al. (in press), the same patients that we have analyzed here do show marked difficulties in the production of grammatical morphemes. The pattern of difficulty differs across languages. English aphasics—particularly Broca's—are more likely to *omit* inflections and function words. Italian and German aphasics—including Broca's—are more likely to *substitute* one grammatical morpheme for another. Nevertheless, all of our patients do demonstrate problems with morphology. This contrasts markedly with the preservation of ordering principles evidenced here. In the same vein, our patients apparently know *where* particular closed class morphemes belong in a sentence, even though they may not always know *which* morpheme to put in a given slot (see also Grodzinsky, 1982). On the locative analysis, Broca's aphasics reliably placed prepositions after the agent/subject and before the locative object. This is only one example of a pattern that holds up in every aspect of morphological production (Bates et al., in press): articles are placed before the noun (even if it is the wrong article), auxiliaries precede the main verb (when the auxiliary is used), and so forth. We often forget that morpheme ordering is in itself a kind of syntax, so we do not even consider the possibility of morpheme-ordering violations. but such violations

are logically possible, and the fact that they do not occur strongly supports the conclusion that positional information is preserved in aphasia—between major constituents, and between closed-class items within those constituents. We have never seen a patient say anything like "Dog the." And in richly inflected languages like Hungarian, where three or four suffixes may be strung together in an obligatorily ordered series, items may be omitted or substituted but they do not (at least so far) ever seem to occur in the wrong position.

We believe, then, that the evidence is good for a unified lexicalist account of symptom patterns in aphasia: Anomia, agrammatism, and paragrammatism may all involve impairments in some form of lexical access. Apparent problems with the "interitem" structures of syntax may be secondary, i.e., by-products of item-retrieval symptoms within the lexicon (including open and/or closed-class retrieval). This kind of finding would be compatible with a growing body of evidence in linguistics and psycholinguistics, suggesting that the lexicon plays a major role in the way that grammatical patterns are acquired, stored, and accessed. But is there a logical inconsistency here? We have said over and over that patients "cling" to phrase structures that are "easy" to access. In a lexicalist system, how do we talk about the relative accessibility of anything as large and abstract as an SVO structure?

There are now several different proposals in the literature offering a lexicalist treatment of phrase structure representation and retrieval. For example, Lapointe (1985) proposes a special phrase-structure lexicon that is governed by syntactic processes (presumably quite separate from the garden-variety word lexicon). Stemberger (1984) also argues that abstract phrase structures are stored and retrieved in a word-like fashion, with word-like resting weights and activation probabilities—but in his proposal they are stored in the "same" lexicon together with less abstract word entries. Bock (1986) has demonstrated empirically that phrase structures like the passive and the dative shift can be "primed" in a fashion that looks very much like priming at the word level; she suggests that phrase-structure construction patterns are stored as a set of condition–action pairs (read "recipes for action") that have resting weights, activation thresholds, and all the other equipment associated with a modern theory of the lexicon. Other theorists have argued that phrase structures are not simply stored "like" lexical items; rather, they are stored "with" lexical items. More specifically, major lexical items like nouns and verbs are richly annotated to specify the kinds of syntactic environments that can occur to their immediate (and perhaps distant) left and right (Bates & Wulfeck, in press; Bresnan, 1982; MacWhinney, 1987). In the more radical lexicalist proposals, more and more of the knowledge and work of syntax is being placed in the lexicon. Lexical retrieval not only *interacts* with phrase-structure planning, lexical retrieval *is* phrase-structure planning.

Possible syntactic frames come up with the words that we choose as we try to arrange our thoughts into a coherent sentence.

When we say that phrase structures are stored in a lexical form, this does not mean that all the possible sentences in a language are memorized. The list of possible sentences in any language is potentially infinite, while the stock of lexical items at a given point in history is always necessarily finite. In the same vein, all lexicalist theories must ultimately account for long-distance dependencies, recursion and embedding, a host of generative syntactic phenomena that transcend the boundaries of a single word. Given these well known facts, it is obvious that a "syntacticon" of phrase-structure types must be very abstract, with symbols that can be expanded or rewritten to permit the infinite variations that are possible in any natural languages. There are in fact a number of lexicalist solutions to this problem, all of which involve some means of tagging lexical items with abstract symbols that indicate what *kind* of item goes to the immediate left or right, what *kind* of particle or complement is to be expected somewhere downstream in the sentence, and so on (Bresnan, 1982; MacWhinney, 1987; see also Gazdar, Klein, Pullum, & Sag, 1985, for a theory of heavily annotated phrase-structure types). These proposals differ markedly from the more familiar structural solutions posed by Chomsky (1957, 1965, 1981), but they handle the same phenomena. The invocation of lexicalist theories in aphasia research is no less justifiable than the use of a more traditional generative grammar framework.

In fact, lexicalist theories may offer some important structural advantages for describing aphasic symptoms. These theories would predict strong interactions between lexical retrieval and syntactic planning. A patient with a lexical problem should have difficulty activating and implementing less probable and/or accessible phrase structures. The "safe harbor" approach that we have seen in our own data may reflect a situation in which the patient holds syntactic complexity at a minimum in order to deal with a difficult lexical problem. But it might also reflect a situation in which syntactic conservatism falls naturally out of deficiencies in lexical retrieval: key words are retrieved in a "weak" or degraded form in which only their most robust or probable phrase-structure possibilities are active. If this view is correct, then we might also expect a "safe harbor" strategy in anomic patients with no other obvious grammatical impairments. In some ongoing work with Italian anomics using the same procedures, we have indeed found a tendency to avoid pragmatic word-order variations, relative to normal controls (see also Miceli et al., 1983). This weakens the argument that reductions in complexity are a response to morphological access problems, but it supports the more general notion that phrase structure access has a lexical base.

The evidence is far from conclusive, and many problems remain unsolved. For example, how can we account for the double-dissociations

that are so often observed between fluent aphasics (who have much more serious problems with open-class words) and nonfluent aphasics (who have more difficulty with closed-class words)? We have gained some advantages by moving grammatical problems into the lexicon, but we still need a principled account of qualitatively different lexical problems (c.f. Bates and Wulfeck, in press, for some proposals). We also need a much more detailed account of the relationship between lexical access and sentence planning. Patients do begin to demonstrate problems with syntax as structural complexity increases, and seriously impaired patients may avoid syntactic planning by restricting themselves to a simple naming strategy (Saffran et al., 1980). Before we conclude that ordering principles are intact in any and all aphasic patients, we need to learn a great deal more about "latent knowledge" of phrase structure.

One approach, pioneered by Linebarger et al. (1983), would involve testing the degree to which patients retain sensitivity to grammatical violations produced by the experimenter (see also Wulfeck, in press). Here it would be particularly useful to contrast violations in *morpheme order* with violations in *morpheme assignment* (e.g., the contrast between "The dogs barking are" vs. "The dogs is barking"). Wulfeck (1987) provides evidence relevant to this point. Four Broca's aphasics tested in an on-line grammaticality judgment task do show significantly greater sensitivity to errors in morpheme position, compared with agreement errors involving exactly the same morphemes. Hence the disparity between item retrieval and item ordering that we have documented here may be operating in error monitoring as well.

Another approach would be to design an array of heavily constrained situations in which various complex structures are obligatory for normal speakers: passives, clefts, and various embedding and gapping constructions. In this vein, some preliminary evidence by Heeschen (1980) suggests that patients can be forced to produce passive structures when those structures are obligatory. And evidence by Kolk (1985) suggests that patients retain language-specific knowledge of possible elliptical forms in their language, using that knowledge to guide the production of telegraphic speech.

We are now attempting to obtain both kinds of evidence in Italian, Hungarian, and several other languages that permit a more detailed series of contrasts between morphology and syntax than the structure of English permits.

APPENDIX:

Percentage of Function Words and Word-Order Types Produced[a]

Group and subject No.	f/f+c	avo/avo+others	av/av+va	vo/vo+ov	ao/ao+ao
Italian Broca's					
18	45.9	50.0	75.0	50.0	100.0
14	47.2	100.0	100.0	100.0	100.0
17	49.3	0.0	66.7	93.3	100.0
20	50.9	100.0	100.0	100.0	91.6
15	52.8	93.3	100.0	93.3	100.0
16	53.5	100.0	90.0	100.0	100.0
13	53.7	100.0	100.0	100.0	100.0
19	60.8	90.9	93.3	92.8	90.9
11	60.9	0.0	33.3	0.0	100.0
12	63.9	0.0	100.0	0.0	50.0
Mean	50.1	63.4	85.8	67.0	89.9
Italian Controls					
8	55.4	75.0	91.6	85.7	84.6
2	55.6	100.0	100.0	100.0	100.0
1	56.2	73.3	100.0	91.6	93.7
6	57.8	100.0	100.0	100.0	100.0
3	59.8	85.7	100.0	88.8	85.7
7	63.6	71.4	100.0	75.0	100.0
4	66.0	87.5	100.0	100.0	100.0
5	70.6	90.0	94.7	92.8	92.3
Mean	59.0	85.4	98.3	91.8	94.6
German Controls					
52	50.3	100.0	57.1	100.0	100.0
57	50.4	100.0	100.0	100.0	100.0
54	51.5	100.0	82.3	100.0	100.0
51	59.2	42.8	83.3	85.7	100.0
53	62.8	85.7	84.6	100.0	100.0
58	64.5	66.6	33.3	100.0	92.3
56	68.3	60.0	76.9	81.8	100.0
Mean	54.4	79.3	74.0	95.4	98.9
German Wernicke's					
31	50.5	100.0	100.0	100.0	100.0
39	55.8	83.3	80.0	76.9	84.6
40	61.0	75.0	83.3	87.5	90.9
32	62.0	84.6	86.7	100.0	100.0
35	62.4	0.0	78.9	85.7	69.2
37	66.0	100.0	100.0	100.0	100.0
36	66.3	100.0	100.0	100.0	100.0
33	67.6	85.7	94.7	100.0	92.8

APPENDIX—*Continued*

Group and subject No.	f/f+c	avo/avo+others	av/av+va	vo/vo+ov	ao/ao+ao
34	67.8	100.0	100.0	100.0	100.0
38	67.8	50.0	70.6	88.8	90.0
Mean	57.1	77.9	89.4	94.0	97.8
Italian Wernicke's					
22	58.1	90.9	94.1	85.7	90.9
27	58.1	88.8	87.5	100.0	83.3
28	58.8	85.7	100.0	85.7	100.0
29	58.8	80.0	85.7	86.6	80.0
25	59.1	57.1	100.0	100.0	100.0
23	59.6	90.0	87.5	100.0	80.0
21	64.1	100.0	100.0	100.0	100.0
24	64.5	25.0	87.5	60.0	75.0
26	68.7	66.6	69.2	83.3	80.0
Mean	60.2	76.0	90.2	90.6	87.7
German Broca's					
41	43.7	100.0	100.0	91.6	100.0
44	43.7	100.0	100.0	100.0	100.0
46	45.7	100.0	94.4	84.6	100.0
43	48.1	100.0	100.0	100.0	100.0
48	50.0	91.6	100.0	84.6	100.0
45	55.6	100.0	100.0	100.0	100.0
42	61.5	93.3	100.0	93.3	100.0
Mean	45.2	97.9	99.2	95.7	100.0
English Broca's					
72	7.4	0.0	100.0	50.0	50.0
73	9.5	60.0	100.0	75.0	71.4
75	34.7	100.0	92.3	91.6	100.0
74	37.5	100.0	100.0	100.0	100.0
71	44.2	100.0	100.0	100.0	100.0
76	52.6	100.0	100.0	82.3	100.0
Mean	27.6	76.7	98.7	83.2	86.9
English Controls					
63	42.5	100.0	100.0	100.0	100.0
65	45.4	100.0	100.0	100.0	100.0
62	47.0	100.0	100.0	100.0	100.0
64	49.0	100.0	100.0	100.0	100.0
61	52.7	100.0	100.0	100.0	100.0
Mean	47.4	100.0	100.0	100.0	100.0

APPENDIX—*Continued*

Group and subject No.	f/f+c	avo/avo+others	av/av+va	vo/vo+ov	ao/ao+ao
English					
Wernicke's					
85	41.3	55.5	92.3	70.0	85.7
81	54.8	78.5	84.2	85.7	85.7
82	57.3	90.9	95.2	92.8	100.0
83	59.7	100.0	100.0	91.6	100.0
84	73.2	100.0	100.0	100.0	100.0
Mean	54.2	85.0	94.4	88.1	93.1

[a] Legends: f/f+c, function words/function words + content words; avo/avo+others, agent-verb-object/agent-verb-object + other possible word orderings; av/av+va, agent-verb/agent-verb + verb agent orderings; vo/vo+ov, verb-object/verb-object + object-verb orderings; ao/ao+oa, agent-object/agent-object + object-agent orderings.

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