THE GRAMMATICAL ANALYSIS OF TEXTS

D. Terence Langendoen

Brooklyn College and CUNY Graduate Center,
New York

The scope of grammar

1. A grammar of a natural language provides recursive definitions of the various constructs that go into the making up of that language.[1] Each language has two sets of simple constructs, one expressive and one semantic. For a spoken language, the expressive constructs are phonological; for a written language, they are orthographic; for a sign language, they are gestural. Thus a spoken, a written, and a gestural language are of necessity different languages, even though there may be a one-to-one correspondence among the members of their sets of expressive constructs, and there is no logical priority of one type of language over another. The remaining constructs of a language are complex, and may be considered to be sets of ordered pairs $\langle e, s \rangle$, where e is an expressive construct of the language and s is a semantic construct. Among the complex constructs of a language that a grammar must define are its morphemes, words, phrases, and sentences.

A classical question of linguistic theory is whether a grammar must define any complex linguistic constructs that are 'larger' than a sentence. In particular, is a text in a given language part of that language in the same way that a sentence in a given language is part of that language? In what follows, I give a number of reasons for believing that the answer to this question is yes, and that consequently two languages can differ even though the sets of morphemes, words, phrases, and sentences of the two languages are the same. However, before I can present these reasons, it is necessary first to indicate what I take the form and organization of a grammar of a natural language to be.

The form and organization of a grammar

2. A grammar of a natural language may be viewed as a system of components, each of which specifies[2] one or more sets of constructs of that language. The task of grammatical theory is to specify the form of each component and its place in the system as a whole.

Let G be a grammar of a spoken natural language L. To specify the sets of simple constructs of L, I assume that G has two components--one phonotactic that specifies the set Φ of phonological constructs of L, and one semotactic that specifies the set Σ of semantic constructs of L. It is possible that the set Σ is the same for all natural languages and hence that the semotactic component of G is specified in advance by the theory of grammar. On the other hand, it is clear that Φ is particular to L and that therefore the phonotactic component of G must be formulated at least in part as a result of research on L itself.

The components that specify the sets of complex constructs of L are hierarchically arranged. The output of each component is a set of ordered pairs $\langle f, s \rangle$, where $f \in \Phi$ and $s \in \Sigma$. At the bottom of the hierarchy is a morphemic component, which specifies the set M of morphemes of the language. Morphemes are of two types: stems, which may be considered categorized morphemes; and affixes, which may be considered uncategorized morphemes. In L, as in any natural language, M is finite, but from this observation it does not follow that its members should simply be listed. Mere listing is insufficient to describe the systematic relations between such pairs of morphemes as English break (noun) and break (verb), sing and sang, etc. (Langendoen, 1979). Moreover, even though morphemes are the smallest constructs of sound and meaning that result from any component of grammar, the morphemic component may make use of complex constructs that are even 'smaller'. Thus, for example, the morphemic component of a grammar of Hebrew would specify <katav, 'he wrote'> as a morpheme of that language, but the morphemic component would also contain, as a terminal element, the root <ktv, 'write'>.[3,4]

The output of the morphemic component of a grammar of L, the morphemes of L, constitutes the terminal vocabulary of the

morphological (or word-formation) component of a grammar of L, which specifies the set W of words and phrasal and sentential affixes of L. For the natural languages I am familiar with, W is an infinite set, though whether this is true for all natural languages, I do not know; nor is it known what the weak generative capacity of the class of morphological components is (for speculation on this point, see Langendoen (forthcoming a)). The words of a language may be classified according to the number of morphemes that combine to form them (e.g., as monomorphemic or polymorphemic); according to their categorization (e.g., as inflected or uninflected); and according to the categorization of the elements that combine to form them (e.g., as complex or compound). I assume that all lexical compounds, including true idiomatic expressions, though not all 'frozen expressions' in the sense of Gross (this volume), are specified by the morphological component.[5] I also assume that all inflected words are specified by the morphological component.[6] Finally, I assume that besides words, W may contain phrasal and sentential affixes, possibly polymorphemic, which are syntactically associated with phrases and sentences, but which are phonologically attached (by syntactic processes) to either the first or last word of that phrase or sentence or to the first or last word of an adjacent phrase or sentence. Such affixes include the 's that appears in English phrases like the king of Sweden's bodyguards and (perhaps) the object pronouns of the various Romance languages. Not all clitics need be analyzed as phrasal or sentential affixes however; some may arise as the result of the phonological reduction of full words, as the 's that appears in the English sentence The king of Sweden's out of town. For further discussion of the analysis of clitics, see Klavans (1980); for our purposes it is sufficient to note that not all the elements of W in a language need have the status of words.

The output of the morphological component of a grammar of L provides the terminal vocabulary of the syntactic component of a grammar of L. According to traditional, structuralist, and generative theories of grammar, the syntactic component of a grammar of a language specifies the infinite set S of sentences of that language. However, none of these theories provides a component that specifies the infinite set P of phrases of a natural language as the output of any component of its

grammar. This situation is undesirable, since we wish to characterize every complex linguistic construct as the output, or as part of the output, of some component of a grammar.

Two ways of rectifying this situation are available. First, we may suppose that there is, intermediate between the morphological and syntactic components, a phrase-formation component that constructs phrases out of words, and that the syntactic component constructs sentences out of phrases rather than directly out of words. Second, we can formulate the syntactic component so that it specifies phrases as well as sentences, by the simple expedient of including phrasal categories among the symbols that appear in the axioms of the syntactic component (cf. Brame 1979a,b).[7]

The first solution may be rejected for the following reason. Certain phrases of a natural language productively incorporate a wide variety of sentence types. For example, noun phrases in English incorporate all declarative sentences (as noun complements) along with an infinite set of sentential structures that have undergone wh-movement (relative clauses). To generate such phrases, essentially all of the syntactic component of English would have to be incorporated into the phrase-formation component of English, resulting in enormous duplication.[8] Since no comparable objection can be raised against the second solution, that is the one we adopt.

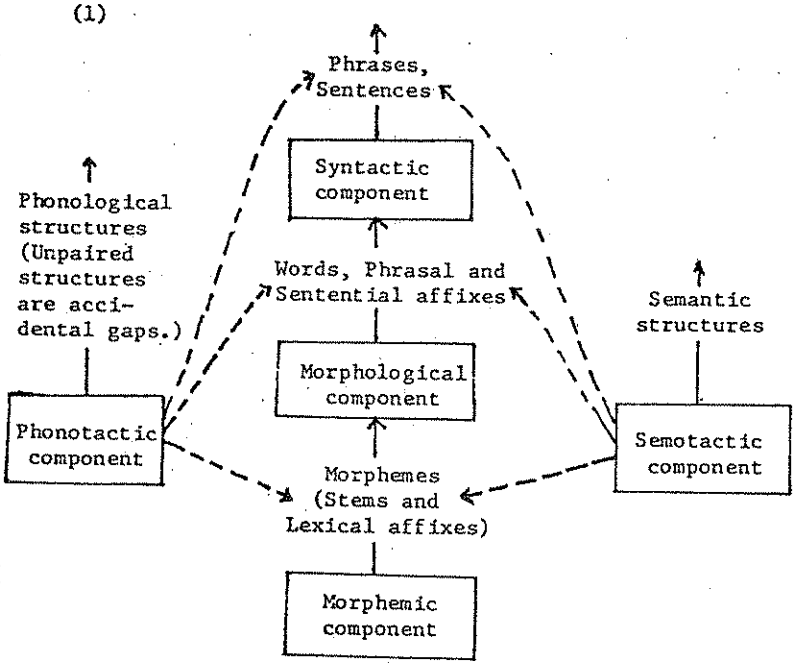
This completes for now our discussion of the components of a grammar of L that specify the complex constructs of L. As we have seen, these components are hierarchically arranged, with the output of a given component constituting the terminal vocabulary of the next higher component. On the other hand, the phonotactic and semotactic components of a grammar of L are not hierarchically arranged, either with respect to each other, or with respect to the other components. Rather, these components act as filters on the outputs of the hierachically arranged components. Specifically, the output of each component that specifies a set of complex constructs of L must be checked for phonotactic and semotactic well-formedness for elements at that level. For example, since every sentence, phrase, word, and stem in English consists of at least a single syllable, whereas affixes may consist simply of a cluster (one or more) of demti-alveolar consonants, the outputs of the hierarchically arranged

components must be checked so that the phonological structures of categorized elements have syllabic form. Similarly, since no morpheme, and possibly no word, in English has propositional structure, the semotactic structures of the constructs specified by the morphemic component and possibly the morphological component of the grammar of English must be checked to make sure that this is so.[9]

In addition, the phonotactic component and possibly the semotactic component of the grammar of L also specify simple constructs of L that are not part of any complex construct of L. Such phonological structures are known as 'accidental gaps' (Halle, 1962).[10] There are semantic accidental gaps as well, but the only known cases involve semantic structures that are expressible by complex constructs that are larger than phrases or sentences. Such gaps can be filled if these constructs are also considered part of the language (see section 3 below).[11]

The arrangement of the components of a grammar of L is thus that shown in 1.[12]

(1)



The arrangement of the components of grammar that specify the complex constructs of a language is essentially that of Bloomfield (1926). For this reason, it is appropriate to call the theory of grammar which incorporates this arrangement 'neostructuralist'; for further discussion, see Langendoen (forthcoming b).

The components of a neostructuralist grammar are identified by the character of their outputs, not by the form of their rules. Thus it is possible that the very same rules or parts of rules can occur in two or more distinct components, a fact that will be important for our subsequent discussion (see section 4 below). This means that the components of a grammar are not autonomous in Chomsky's sense (Chomsky, 1975; Woisetschlaeger, 1980), but they are 'strictly separated' in the sense of the post-Bloomfieldian structural linguists. Moreover, those operations that take place within each component that do not simply involve nonterminal elements affect either phonological or semantic structures. Thus syntax, for example, can be thought of as the phonology and semantics of phrase and sentence formation; in particular, its rules include all of the semantic projection rules, in the sense of Katz (1972), that derive the meanings of phrases and sentences from the meanings of the words and phrasal and sentential affixes they contain. Syntax, then, is not something that stands apart from semantics and phonology. To the extent that syntax is not the phonology of the phrase and sentence, it is their semantics; to the extent that syntax is not the semantics of the phrase and sentence, it is their phonology. The same remarks obtain mutatis mutandis for morphology and morphemics.

The ultimate constituents of texts

3. Texts are conventionally thought of as ultimately made up of sequences of sentences, and such sequences are often thought of as semantically equivalent to single, possibly complex or coordinate, sentences (Katz & Fodor, 1963:490-1). However, to effect these reductions, enormous transformational power is required, and furthermore they are not always successful. To begin with, there may be no acceptable way to combine certain textually well formed sequences of sentences into a single complex or coordinate

sentence without changing the meaning of the text. Consider 2.

(2) You've got something in your hand. What is it? Show it to me.

Second, texts may consist of sequences of interspersed phrases and sentences, and again there may be no acceptable way to exactly paraphrase those sequences as sequences of sentences. Consider 3.

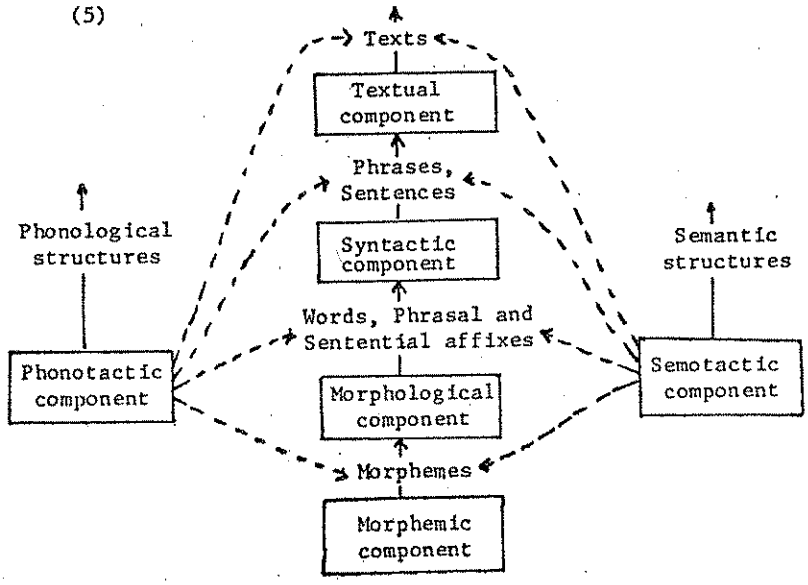
(3) We can't wait any longer. To hell with him.

Finally, as Yanofsky (1978) observes, a text may consist exclusively of a sequence of one or more phrases, in which case no meaning-preserving derivation from a sequence of sentences is ever possible. Consider 4.

(4) Your move.

Thus texts cannot be viewed as semantically equivalent to single, possibly complex or coordinate, sentences, or even to sequences of sentences. The ultimate constituents of texts are their phrases and sentences.[13] Grammatical theory can explain this property of texts if the texts of a language are specified by a component of grammar of that language whose terminal vocabulary consists of phrases and sentences. However, if a textual component is added to the top of the hierarchy of components in 1, precisely this effect is achieved. We therefore augment the theory of grammar sketched in 1 with a textual component as in 5.[14]

(5)



By specifying texts as complex constructs of a language, we provide phonological pairings for the only known cases of semantic structures in a language that previously lacked them (cf. section 2). Thus the possibility remains that there are no semantic accidental gaps in any natural language.

Among the phrases that are directly specified as phrases by the textual component of a grammar of English, and not derived from full sentences, are certain replies to questions, as in 6, and certain interrogative retorts to statements, as in 7.

(6) Who is buried in Grant's tomb? Your great-grandfather.

(7) Max found Moritz passed out on a park bench. Where?

The interpretation of your great-grandfather in 6 as an answer to the question Who is buried in Grant's tomb? is a property of the text 6 as a whole, and results from the application of textual semantic rules operating on the constituents of 6. Similarly in 7, the interpretation of where? as requesting further information as to the location of the park bench on which Max found Moritz passed out is a property of the text 7 as a whole. In general, textual ellipsis is reconstructed in neostructuralist theory as the result of combining the interpretation of an elliptical constituent with that of its antecedent. It involves neither the deletion of strings under identity, nor the interpretation of designated 'null' strings under anaphoric control. Nothing that is not actually present in the text itself is required for the interpretation of textual ellipsis. We shall have more to say about ellipsis, and textual ellipsis in particular, in section 4 below.

Interrogative retorts in English show an interesting pattern of inversion of wh-phrase and preposition. Part of this pattern is shown in 8.

(8) a. Judy bought a gorgeous couch. Who from?

b. Billy hit me. What with?

Van Riemsdijk (1978) has argued that this pattern shows that preposition phrases in English contain a complementizer constituent, which can be filled by a wh-phrase. In a sentence, the wh-phrase can (in fact, must) then move into the complementizer position of the sentence, as in 9.

(9) a. Who did she buy it from?

b. What did he hit you with?

According to van Riemsdijk, the possibility of preposition stranding in English, as in 9, depends on the ability of the wh-phrase object of a preposition to move into the complementizer position of the preposition phrase, since the subjacency condition of Chomsky (1973) would prevent the wh-phrase from moving directly into sentence-complementizer position from the position of object of a preposition. In a language like French, whose preposition phrases lack a complementizer constituent (as evidenced by the ungrammaticality of such phrases as *quoi avec in French), preposition stranding in sentences is in fact disallowed.

However, the pattern of inversion in English interrogative retorts is more complex than van Riemsdijk realized. Consider the texts in 10 and the corresponding sentences in 11.

(10) a. Billy hit me. *Which club with?

b. Billy hit me. *Whose club with?

(11) a. Which club did he hit you with?

b. Whose club did he hit you with?

As the ungrammaticality in English of the phrases *which club with? and *whose club with? show, prepositions cannot invert with wh-phrases that consist of more than one word. On van Riemsdijk's account, this presumably means that such phrases cannot be moved into the complementizer position of preposition phrases. But how, then, can he account for the grammaticality in English of the sentences in 11, in which the wh-phrases which club and whose club have moved into sentence-complementizer position from preposition phrases?

The pattern of inversion in interrogative retorts in English confirms that such phrases are directly specified by the syntactic component of a grammar of English, rather than derived from full sentences. In phrases, the inversion of wh-phrases with prepositions is limited to single-word phrases. No such limitation is placed on the syntactic operations that specify English sentences that contain stranded prepositions.

Ellipsis in sentences and texts

4. The postulation of a textual component of a grammar of a natural language enables us to provide a grammatically conservative, yet descriptively adequate, analysis of elliptical

constructions. Consider first the text 12.

(12) You know that I always turn up late for rehearsals. Everyone does.

This text is ambiguous in written English.[15] On one interpretation, it entails 13a; on the other, 13b.

(13) a. Everyone knows that I always turn up late for rehearsals.

b. Everyone always turns up late for rehearsals.

This ambiguity, however, does not result from the ambiguity of either of the sentences of 12, since neither sentence is ambiguous in the relevant respect. Rather, it results from the process of combining the meanings of the two sentences into the meaning of the text as a whole; a process that assigns either of the predicates of the first sentence to the subject of the second. Accordingly, univocal meanings are assigned to each of the sentences in 12 by the syntactic component, while projection rules in the textual component assign to the text as a whole its two distinct meanings. This analysis is grammatically conservative, inasmuch as the second sentence of the text 12 is given only a single analysis syntactically, and at no stage in its derivation is it ever treated as ambiguous.[16]

My conservatism runs counter to some of the more liberal-minded suggestions that have been made at this conference. For example, Nils Erik Enkvist claims that the study of texts has revealed that certain sentences can only be fully analyzed with reference to elements that lie outside them in the text. My contention is that the analysis of sentences, qua sentences, requires nothing that occurs outside them in the text. In order to understand the text itself in terms of its constituent sentences, one will of course make reference to elements that occur in different sentences, but this analysis takes place in the textual component of a grammar, not in the syntactic component.

This is not to say that there are no processes that occur in both the syntactic and textual components of a grammar. Just as the text 12 is ambiguous, so is the sentence 14.

(14) You know that I always turn up late for rehearsals, if everyone does.

Moreover, just as both sentences of 12 are unambiguous in the relevant respects, so are both clauses of 14. The ambiguity of 14 results from the process of combining the meanings of the two clauses in such a way that either of the predicates of the first clause is assigned to the subject of the second. This syntactic process parallels the textual process that derives the meaning of the text 12. These two processes correspond to what Williams (1977) calls the 'VP-rule', which he claims is part of the discourse grammar (i.e., the textual component of the grammar) of English, but which must also be part of the sentence grammar (i.e., the syntactic component of the grammar) of English.

The VP-rule is subject to the well-known constraint on anaphoric processes generally that the elliptical clause or sentence must either follow or be grammatically subordinate to the full clause or sentence (Langacker, 1969). This constraint holds on both the syntactic and the textual process, as the examples in 15 and 16 show.

(15) a. Because the city makes welfare payments, the state refuses to.

b. The city makes welfare payments because the state refuses to.

c. Because the state refuses to, the city makes welfare payments.

d. *The state refuses to because the city makes welfare payments.

(16) a. The city makes welfare payments. The state refuses to.

b. *The state refuses to. The city makes welfare payments.

In 15a-c, the interpretation 'the state refuses to make welfare payments' is part of the interpretation of the sentences as a whole, as a result of the application of the VP-rule in the syntactic component of the grammar of English. In 15d, however, this interpretation is not provided, since the elliptical clause both precedes and is not subordinate to the full clause. Similarly in 16a, the interpreation 'the state refuses to make welfare payments' is part of the interpretation of the text as a whole, as a result of the application of the VP-rule in the textual component of the grammar of

English. In 16b, on the other hand, this interpretation is not provided, since again the elliptical clause both precedes and is not subordinate to the full clause.

An obvious objection to the theory of grammar I am proposing here is that it requires duplicate (in fact, in certain cases, multiple) statements of rules or parts of rules of grammar. The elimination of duplication from the statement of grammatical rules is typically justified on the grounds that it results in the expression of significant generalizations about the language under description; the fewer and more general statements there are, the more independent ground each statement covers. However, the elimination of duplication is only effective in this way if the set of rules is finite. If the set of rules of grammar is infinite, then the only way to describe it formally is to write another grammar (we may call it, following Langendoen (1976), a hypergrammar) that specifies it, and clearly the hypergrammar is not necessarily simplified if duplicate parts of rules of grammar are eliminated. On the contrary, the hypergrammar might even be complicated by such elimination, just as the grammar of English might be complicated if we were to reduce the inventory of English sentences by combining similar sentences together and eliminating all but one occurrence of their common parts.

To show that the set of rules of a grammar of a natural language is infinite is not difficult. First consider any natural language with an infinite vocabulary (set of words). Since there is at least one syntactic rule, distinct from all other rules, that mentions each vocabulary item (namely a rule that specifies its privileges of occurrence in syntactic environments), the grammars of such languages must have infinitely many rules. Now consider any natural language with a finite vocabulary (there may be no such language). Such a language, nevertheless, has infinitely many phrases and sentences. Since there is at least one textual rule, distinct from all other rules, that mentions each phrase or sentence, the grammars of such languages, too, have infinitely many rules.

Not only do grammars of natural languages have infinitely many rules, but these rules are distributed over a variety of components. We can imagine that a hypergrammar that specifies the rules of a given grammar also indicates which component or

components a given rule belongs to. Again, the hypergrammar may be simplified if it assigns a given rule to more than one component. In particular, the assignment of the VP-rule to both the syntactic and the textual components of the grammar of English, far from violating canons of simplicity, is required by them, given the facts of English as described above.[1]

Having found one case of rule duplication necessitated by the analysis of grammars into components, it is easy to find others. For example, the English affix /z/ is both a lexical affix (forming the plural of nouns, genitive singular or plural of nouns, and the third-person-singular present tense of verbs) and a phrasal affix (forming the genitive of noun phrases), and also arises as a clitic upon the contraction of _is_ or _has_. Regardless of its status, the rules of grammar that govern the pronunciation of words to which it is affixed are the same. Since it occurs as a lexical affix, those rules must occur in the morphological component of a grammar of English; since it also occurs as a phrasal affix and as a clitic, they must also occur in the syntactic component of a grammar of English. Similarly, for any monomorphemic adjective in the English lexicon, there is a rule in the morphemic component that specifies it as a morpheme, and an identical rule in the morphological component that specifies it as a word.[18]

The relative merits of alternative grammars of a given natural language cannot be determined as a simple (e.g., linear) function of the amount of rule duplication. As we have just seen, a certain amount of such duplication is tolerated, and perhaps even required. Too much, however, cannot be, as we would rank a grammar lower that contained two identical components, where one would do the job. We have, in fact, already rejected a grammar of English that contains both a phrase-specifying component and a sentence-specifying component in favor of a grammar that contains a single phrase-and-sentence-specifying component, on the grounds that the two components would contain nearly identical sets of rules. Roger Schank asked during the discussion of this paper how one knows when one has arrived at the correct grammar of a language. I wish I knew; I wish I had even a faint idea as to the exact criteria by which one evaluates alternative grammars. Right now, I am only at the stage of beginning

to get clear as to how the components of grammar are sorted out. Our degree of understanding the facts of natural languages is currently too small for the issue of grammar evaluation to be developed much beyond the point it has been developed here or by other linguistic theoreticians.

Some general properties of the textual component

5. Every component of a grammar of a natural language contains constituent-structure rules that describe the hierarchical structures of the elements specified by that component. Most familiar are the constituent-structure rules of the syntactic component, that describe the ways in which words combine to form the structures of phrases and sentences. Less familiar are the constituent-structure rules of the morphological, morphemic, phonotactic, and semotactic components. Constituent-structure rules are needed in the morphological component to describe the hierarchical arrangements of morphemes within words; in particular, to account for structural ambiguities of the type illustrated by the English word unbendable. Such rules are also needed in the phonotactic component to describe the internal structures of syllables and the patterning of syllables in 'metrical' structures (Liberman & Prince, 1977). Finally, such rules are needed in the semotactic component to describe the hierarchical arrangements of sememes within semantic structures, as illustrated by the 'semantic markers' proposed by Katz (1972, 1977).

Chomsky (1970), and following him, Jackendoff (1977), have proposed a theory of constituent structure for the syntactic component known as the 'X-bar' theory. This theory has a number of virtues, among them the ability to reconstruct in a formally elegant way the notions 'head' and 'modifier', and to provide for more than one higher-level category for a given lexical category.[19] Since the X-bar theory is a theory of constituent structure, and since, as we have just seen, other components of grammar besides the syntactic component contain constituent-structure rules, the X-bar theory is easily generalized to these components. In particular, we may suppose that the constituent-structure rules of the morphological, morphemic, phonotactic, and semotactic components

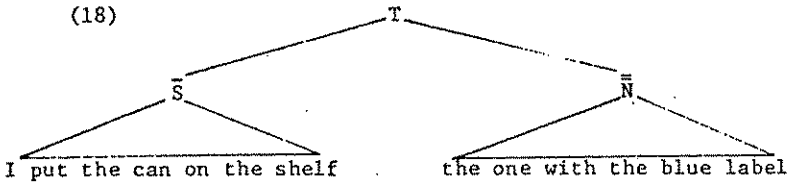
are all formalized in accordance with the X-bar theory of constituent structure.[20]

Nor is there any reason to exclude the constituent-structure rules of the textual component of a grammar from the provisions of the X-bar theory. Consider first the structure of the text in 17.[21]

(17) I put the can on the shelf. The one with the blue label.

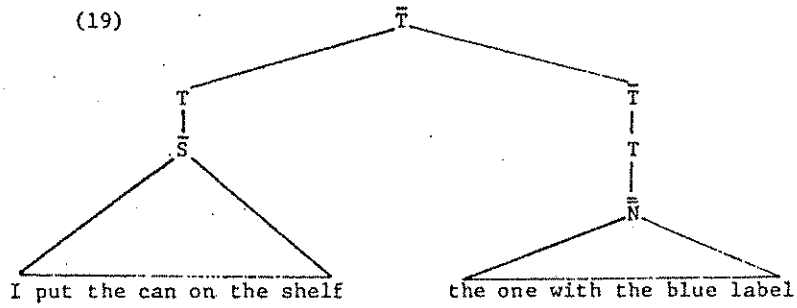
At minimum, 17 consists of a declarative sentence ($\bar{S}$) and a noun phrase ($\bar{\bar{N}}$). Since the whole is a text (T), we may express its hierarchical structure as in 18.

(18)



However, 18 does not reveal that the sentence is the head of the text and that the noun phrase is its modifier. To represent that information, we introduce a higher-level textual category $\bar{T}$, and express the hierarchical structure of 17 as in 19.

(19)



To specify the hierarchical structure of 19, we postulate the constituent-structure rules in 20.

(20) a. $\bar{\bar{T}} \rightarrow [_{\bar{\bar{T}}}\ T\ (\bar{T})\ ]_{\bar{\bar{T}}}$

b. $T \rightarrow [_{T}\ \bar{S}\ ]_{T}$

c. $T \rightarrow [_{T}\ \bar{\bar{N}}\ ]_{T}$

The rules in 20 permit both $\bar{S}$ and $\bar{\bar{N}}$ to manifest the head of a text. In fact, $\bar{\bar{N}}$ can only do so when it occurs alone. Thus we replace 20c by the rule-schema 21.

(21) $T \rightarrow [_T \bar{\bar{N}}]_T / < [_{\bar{T}} X> [_{\bar{T}} \_\_]_{\bar{T}} <]_{\bar{T}}>$

In an English text that contains only sentences, it is not clear that any sentence is grammatically subordinate to any other. Rather, all such sentences may have to be coordinated, a fact (if it is a fact) that perhaps originally gave rise to the illusion that texts are semantically equivalent to single coordinate sentences.[22] Intermediate textual categories, such as 'paragraph', may be represented by higher-level projections of the category T, or perhaps by entirely new categories.

The insertion of the elements of the terminal vocabulary of the textual component of a grammar of a natural language (its phrases and sentences) is handled by a battery of rules that is analogous to the set of lexical-insertion rules of the syntactic component. The insertion of these elements is governed by general principles that mainly have to do with the form of the environments in which they are allowed to appear. For example, those environments can only be described in terms of elements of the same type as the element being inserted, categories of the component in which the element occurs as a member of the terminal vocabulary, and variables that range over those elements and categories, possibly restricted by semantic aspects of those variable structures. In particular, the environment in a phrase or sentence in which a given word may appear must be specified solely in terms of other words, syntactic categories, and (semantically restricted) variables. Thus the English verb admire appears in the class of environments represented in 22.[23]

(22) $([_{\bar{\bar{N}}} X_1]_{\bar{\bar{N}}})[_{\bar{V}} \_\_ [_{\bar{\bar{N}}} X_3]_{\bar{\bar{N}}}([_{\bar{P}} [_P \text{ for }]_P [_{\bar{\bar{N}}} X_4]_{\bar{\bar{N}}}]_{\bar{P}})]_{\bar{V}}$,

where X_1 is human and X_4 is a property of X_3.

Next, consider the textual environments in which the English noun phrase the one with the blue label occurs. Above, we pointed out that when phrases occur together in an English text with a sentence, those phrases must be textually subordinate to that sentence. However, the phrase the one with the blue label cannot occur subordinate to just any English sentence; for example, the text 23 is not well formed.[24]

23. *Love is blind. The one with the blue label.

A moment's reflection leads us to conclude that the phrase

the one with the blue label can be subordinate in an English text to any sentence that is, roughly speaking, about a physical object with a solid surface. The semantic property of 'aboutness' holds of a sentence as a whole, and arises upon application of projection rules to the semantic structures of its parts. As such, it is available for the statement of restrictions on variables in textual structures.[25]

The rules that limit the insertion of elements into a text on the basis of cooccurring elements guarantee that certain texts manifest at least a minimal amount of 'coherence' (Halliday, 1967). However, I am dubious that a purely grammatical account of coherence is possible, because the rules that limit the insertion of elements into coordinate structures (which provide the preponderant amount of textual structure in English discourse) are much less constrained by considerations of coherence than are rules that limit the insertion of elements into superordinate and subordinate structures.

Once the rules for inserting phrases and sentences have applied, phonological and semantic projection rules apply to derive the phonological and semantic structures of texts. These are then checked for well-formedness against the outputs of the phonotactic and semotactic components of the grammar, completing their derivations.

On the psychological reality of neostructuralist grammars

6. Neostructuralist grammars constructed on the model of 5 are fully computational. Every grammatical element of a text of a language is computed, down to the last distinctive feature of each of its phonemes. Clearly, such a model is inappropriate for ordinary linguistic performance, in which it does not seem that every grammatical property of an utterance (whether produced or comprehended) is computed from scratch. Most words, we imagine, are selected from a lexicon that is more or less already fully constructed, and so are many phrases and even sentences.

However, even if not every aspect of an utterance is computed from scratch upon its production or comprehension, it does not follow that a fully computational model is inappropriate as a model of human linguistic ability.[26] When

we access a word, we access, at least potentially, all of the grammatical properties and relations of that word: its constituent structure, its component morphemes, the phonemes that make up the phonological structures of those morphemes, the distinctive features of those phonemes, the meanings of the word, its privileges of occurrence in phrases and sentences, etc. Where did all of this structural information come from? Presumably it was computed, most likely at times when we were not even consciously thinking about the word.

In providing for every aspect of grammatical structure, however, neostructuralist grammars do not provide, in Christopher Habel and Hans-Jochen Schneider's words "all theoretical and practical preconditions of a model of human language understanding." Nor do I think they should. Grammars tell us what languages are, not how they are used. If Roger Schank is correct, we can make considerable progress in understanding human language understanding with no clear notion of grammar at all. I believe that, when we have a complete understanding both of the nature of language and of the nature of language use, we will then see how knowledge of language contributes to knowledge of language use. But until that time, I see no point in confusing the goal of giving an account of language itself with the goal of giving an account of its use.

Footnotes

[1]This use of the term 'grammar' corresponds to Chomsky's use of it in the following passage (1957:11).

> A linguistic level, such as phonemics, morphology, phrase structure, is essentially a set of descriptive devices that are made available for the construction of grammars; it constitutes a certain method for representing utterances. We can determine the adequacy of a linguistic theory by developing rigorously and precisely the form of grammar corresponding to the set of levels contained within this theory, and then investigating the possibility of constructing simple and revealing grammars of this form for natural languages.

Elsewhere, for example in Chomsky (1957:18), he uses the term 'grammar' to refer to what we call here the 'syntactic component of a grammar'. This confusion between 'grammar' and 'syntax' is endemic in the linguistic literature and has even found expression at this conference.

[2]I use the term 'specifies' rather than 'generates' so as not to prejudge the character of the components of a grammar. They may be generative in the classical Chomskyan sense, or they may act as filters checking the well-formedness of candidate structures in the manner of McCawley (1968), Gazdar (1980), and others. Benny Brodda suggested during the discussion of this paper that the latter approach is the more suitable one if grammars of the sort envisioned here are to have reasonable psychological reality (cf. section 6 below).

[3]More precisely, the phonological structure of the root is a tree structure in which the vowel categories dominate the null string; i.e., the vowels occur as 'traces' in the phonological structure of the root (Langendoen, 1979).

[4]In my presentation at the conference, and in the prepublication draft of this paper, I indicated that the phonotactic and semotactic components of grammar provide the terminal vocabulary of the morphemic component. That was a mistake. The terminal vocabulary of the morphemic component is made up of complex, not simple, constructs. The relationship of the phonotactic and semotactic components to the components that specify the complex constructs of a language is discussed further below in this section.

[5]I take expressions such as kick the bucket and put two and two together to be compound words in English, and hence specified by the morphological component of the grammar of English. By so classifying them, their immunity to any syntactic modification is immediately explained. On the other hand, such expressions as take advantage of are not compound words, and their formation is specified in the syntactic component of the grammar of English. In this way, we provide for their (albeit limited) syntactic modifiability, as in be taken advantage of and take unfair advantage of. I would have thought that take the bull by the horns is also a lexical compound in English, but Maurice Gross pointed out to me at the conference the possibility in English of modifying it syntactically, as in take the bull of linguistics by the horns of syntax.

[6]This assumption is at variance with the usual assumptions made by generative grammarians. Prior to Chomsky (1970), it was assumed that all word formation is specified syntactically, an assumption that continued in the work of generative semanticists (for discussion, see Langendoen & Bever (1973)). Chomsky's 'lexicalist hypothesis' can be understood as the assumption that lexemes (uninflected words, including, presumably, compound words) are specified morphologically, but that inflected words are specified syntactically, essentially as the result of syntactic operations that associate inflectional categories (Tense, Case, etc.) with lexemes. All such assumptions about the form of grammar can be faulted for failing to provide a unified account of the notion 'word'. The first suggestion by a generative grammarian that inflected words should also be specified morphologically is found in Halle (1973).

[7]Jackendoff (1977) contends that the category 'Sentence' is itself a phrasal category within the X-bar theory of categories of grammar. If this is correct, then we can think of the syntactic component as simply specifying the set P of phrases of a language, including its sentential phrases.

[8]It might be objected on similar grounds that compound words should not be specified by the word-formation component, since the rules needed to specify such words also appear in the syntactic component. However, as we point out in section 4 below, this objection by itself is not compelling; moreover, compound words are not productively constructed by rules that have syntactic counterparts (for example, the morphological rules in English that specify such compound words as lily-of-the-valley are unproductive), while productively constructed compound words are formed by rules that differ from syntactic rules (for example, the productive morphological rules that construct such English compound words as peace-loving differ from the syntactic rules of English).

[9]I hedge concerning English words because of compounds like devil-may-care, which appear to have propositional structure. This matter requires further investigation.

[10]This definition of 'accidental gap' is superior to Halle's, who considered only those phonological structures that fail to be a morpheme or a word in a language to be accidental gaps. By his definition, the phonological structure of the phrase Bill's book (/bĭlzbŭk/) is an accidental gap in English, a clearly counterintuitive result.

[11]Some of the examples of semantic accidental gaps that have been proposed, for example the absence in English of a word that signifies the body of a dead plant (cf. corpse and carcass) are not true accidental gaps, since there are phrases in the languages in question that have the required meanings.

If the semotactic components of every natural language are the same, and if there are no semantic accidental gaps in any natural language, then Katz's effability thesis is correct and complete intertranslatability of the senses of expressions betwen natural languages is assured (Katz, 1979).

[12]The solid lines in 1 designate outputs of the components from which they emanate, and the terminal vocabularies of the components to which they connect. The broken lines indicate filtering by the phonotactic and semotactic components.

[13]We leave open the possibility that a text may also have as an ultimate constituent a 'textual affix' that is phonologically joined to the first or last word of a text; for example, a particle with the meaning 'this is the end of the story'.

It is also not clear whether all of the constituents of a text occur sequentially. Certainly, tokens of certain texts can contain elements that occur simultaneously, as in the dialogue i.

(i) A: Who are the current senators from New York?

B: Jacob Javits. }
C: Pat Moynihan. } (together)

A: Correct.

Perhaps under the most suitable idealization, the elements of a text occur sequentially, but whether this should be the case has yet to be determined.

[14]The textual component posited here is comparable to the 'discourse grammar' proposed by Williams (1977), which he identifies as a 'subgrammar' of the grammar of a language as a whole; the other 'subgrammar' being called 'sentence grammar'. Williams has little to say about discourse grammar, except that its rules all apply after all sentence-grammar rules have applied. This observation follows, of course, from the fact that the terminal vocabulary of the discourse grammar consists of the output of the sentence grammar.

I find Williams' terminology unsatisfactory for a number of reasons. First, it equivocates on the term 'grammar' (cf. fn. 1). Second, it suggests that the syntactic component only specifies sentences, whereas it must also specify phrases. Third, it suggests that a grammar of a natural language has only two components, syntactic and textual, whereas it in fact has many more.

[15]As Nils Erik Enkvist pointed out during the discussion, the text 12 may not be ambiguous in spoken English.

[16]The foregoing analysis of the text 12 is even more conservative than an analysis of it along the lines of the highly 'interpretivist' theory of Williams (1977). According to Williams, the elliptical sentence Everyone does receives two interpretations in 12 by virtue of his 'VP-rule'; whereas, according to the analysis suggested here, it receives only the one interpretation it gets from the semantic projection rules of the syntactic component. The ambiguity of 12 is held to be a semantic property of the text itself, and not of any of its parts.

[17]It is not clear to me whether the two VP-rules of English (one syntactic and one textual) are exactly the same or only very similar. In either case, the mere fact that they are applicable in two domains of grammar is sufficient basis for distinguishing them.

[18] I use the category 'Adjective' to illustrate this point, since monomorphemic nouns and verbs in English may have different categorial statuses as words (inflected) and as morphemes (uninflected).

[19] Jackendoff proposes that for each lexical category, there are exactly three higher-level categories. I see no reason to fix the number of higher level categories for a given textual category in advance.

[20] Because of the way the various components relate to one another, it may be necessary to make some adjustments in the categories of certain components. For example, it may be necessary to redefine the lexical categories of the syntactic component as having either zero or one bar (the former for uninflected words, the latter for inflected words).

[21] Östen Dahl, in his discussion of this paper, raises the question whether the noun phrase the one with the blue label is simply in apposition to the noun phrase the can in the full sentence, so that 17, rather than being a text with two constituents, is simply a text with a single sentence as its ultimate constituent. He points out that in highly inflected languages, such as Russian, the noun (or pronoun) corresponding to one would be in the same case as the noun corresponding to can, suggesting a syntactic, rather than a textual, connection between the two elements.

My inclination is to view the situation essentially in reverse; that is, when a sentence appears to contain a constituent (phrase or sentence) in apposition to another constituent, the appositive constituent is really an independent textual constituent. If, as I suggested in fn. 13 above, the elements of a text do not have to occur in sequence, then the fact that appositive constituents 'interrupt' other constituents in a larger structure is provided for. This solution to the problem of apposition is particularly attractive, since it is often not at all clear how one assigns constituent structure to a sentence with an appositive constituent in it.

Even if, however, Dahl is able to show that 17 really consists of a single sentence, he cannot seriously argue that the noun phrase the one who interviewed Dr. Strangelove occurs in syntactic apposition to the noun phrase your friend in the text i.

(i) What did your friend say? Which friend are you talking about? The one who interviewed Dr. Strangelove.

[22] In the prepublication draft of this paper, I contended that certain sentence adverbs, such as nevertheless, function as markers of textual subordination in English. Östen Dahl's analysis of this claim in his discussion of that paper has succeeded in disabusing me of it.

[23] This is an approximation. Moreover, the semantic restrictions on the variables X_1, X_3, and X_4 in 22 are stated informally. I do not know what the most appropriate formalization of such restrictions is.

[24] This is not to say that 23 could not be appropriately uttered on some occasion. The amount of background information

that would have to be available to make sense of 23, however, convinces me that as a purely grammatical object, 23 is not well formed.

[25]Östen Dahl suggests that the phrase the one with the blue label can cooccur with a sentence in a text only if it contains an expression with which the phrase can be coindexed. Then, since there is no expression in the sentence Love is blind with which that phrase can be coindexed, 23 is ill formed. However, the appearance in a sentence of an expression with which a textually cooccurring phrase can be coindexed is neither necessary nor sufficient to guarantee textual well-formedness. It is not necessary because of cases like i, and not sufficient because of cases like ii.

(i) The doctor is almost finished. Just a couple more minutes.

(ii) *The love which you expressed for me by putting the can on the shelf can never be reciprocated. The one with the blue label.

[26]The fact that grammars contain components with infinitely many rules means that grammars as such cannot be mentally represented. At best, they can be represented in schematic fashion, or (less plausibly) by the hypergrammars that specify them. As Jerry Katz has pointed out to me, one who knows a grammar in schematic form or who knows a hypergrammar that specifies a grammar cannot thereby be said to know that grammar. Human beings may indeed have only imperfect knowledge of the languages they speak, write, or sign, indicating that perhaps the best way of viewing a language is as an abstract object (Katz, 1980).

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DISCUSSION OF D. TERENCE LANGENDOEN'S PAPER "THE GRAMMATICAL ANALYSIS OF TEXTS"

Christopher Habel & Hans-Jochen Schneider

Institute of Applied Informatics, Technical University of Berlin

Our comments on Langendoen's paper will have the following structure.[1] After characterizing the basic points of view of the discussants we will ask a few questions the answers to which cannot be deduced from Langendoen's paper. Certain suggestions will be made to these problems. In this comment we cannot give a detailed description of our own work but hope to be able to clarify some points in the discussion. (Cf. Habel/Rollinger/Schmidt/Schneider 1980 for a more detailed description).

1. The discussants' points of view

To begin with we have to clarify our point of view of text processing as far as it is relevant for discussing Langendoen's theses.

a. The function of a grammar consists not only in being a theoretical construct of linguists for enumerating or generating in a formal manner phrases, sentences or texts of a natural language. Rather the grammar of a language has to be the basis for describing and explaining language use (text production and text understanding).

b. Description and explanation of language use means especially that the user of the language, that is the speaker and the listener of the speech community, is an important entity in the theory of grammar and communication models. A grammar e.g. has to explain how and why a listener understands an utterance of a language.

c. Grammars viewed as lingustic theories have to be checked against reality, i.e. we have to do an empir-

[1] This final version of our comments was written after the symposium. The papers and comments by the participants as well as the discussions during the symposium led us to further insights; the responsibility for errors and misinterpretations is our own.

ical checking. One possibility of confirming a linguistic theory is the computer test. The status of linguistic theories which cannot be tested by means of formal methods (i.e. the computer) seems doubtful.
d. Computer science, particularly computational linguistics, is not only a field for theory-testing but also one of practical application. We, therefore, demand that the scientific community develop a theory of language understanding that can be operationalized. By such an operationalization some practical problems, such as natural-language information systems, question-answering-systems, etc., can be solved. The adequacy of linguistic theories should be measured by degrees of operationality.

2. Requirements for text-representation and analysis

The most important requirement is, therefore, to have a theory of text understanding and representation through which it is possible to develop systems that "understand" texts. From the theoretical point of view this means: What are the relations between strings of phonemes (or graphemes) and meanings? What kind of entities are meanings? From a more practical point of view there are the following questions: What possibilities exist to show that computer systems understand natural language? (Evidences for language-understanding - in Artificial Intelligence - are: the ability to answer questions, to translate and to paraphrase texts (stories), to abstract the relevant information from a text). If a computer system possesses these abilities we can apply such a system in a practical environment. New technologies, such as worldwide communication and information networks, form the background of these comments. We must be aware that from a technical point of view we can have - within the next decade - communication and cooperation between the casual user and computer systems on a large scale. For a precise experiment of natural-language understanding by a computer system we propose the environment of question

answering and paraphrasing. The "intellectual" abilities that are necessary for such an understanding are: constructing the meaning of an utterance, generating natural-language paraphrases of meanings, inferring meanings from meanings, producing response sentences.

3. The problem of semantic structures

Langendoen uses the set Σ of semantic structures at several locations, especially in connection with Katz's "effability thesis". But he does not explain how semantic structures are defined and in what way they are constructed by the grammar. As semantic structures correspond to meaning, the lack of a precise definition of semantic structures explains the non-existence of an explication of 'meaning' in Langendoen's paper.

Question 1: What kind of entities are semantic structures? What kind of entities are meanings?

This question gives rise to further problems which are not solved by Langendoen. As semantic structures are elements of the terminal alphabets of the morphemic, word-formation, syntactic and textual component of the grammar, there must be devices to 'compute' the semantic structures of a higher level out of the semantic structures of the lower levels.

Question 2: What are the principles for computing semantic structures of a higher level out of semantic structures of lower levels? Is the Fregean Principle applicable?

We propose logical structures as semantic structures, i.e. as semantic representations. What kinds of logical structures are needed to solve the "representation problem of natural languages"? By this we mean the problem of developing an adequate semantic and knowledge representation language. In his contribution to this symposium Schank showed that the problems of text representation, of meaning representation and of knowledge representation are identical. We are confident

that we must use an extended logic, i.e. a logic with further operators, for example the operators of modal logic (deontic, assertoric, temporal, etc.) Furthermore we propose some operators which are not well known in usual logic, e.g. causal, purpose, and so on. (These operators work on events, acts and state of affairs.) Using an appropriate interpretation[1] of such logical structures we have the equivalence of such conceptual structures as 'frames' or 'scripts' (Cf. Schank/Abelson 1977) which are successfully used in Artificial Intelligence. The structure of such a semantic representation language enables us to make use of the results and inquiries in logico-linguistic semantics as well as in Artificial Intelligence. At this point we have to emphasize one important requirement on semantic structures: Semantic structures must be entities such that the inferential processes of man (or machines) can work on these semantic structures. (This does not mean to say that the mental representations of men are logical structures!!)

The semantic representation language proposed by us (Cf. Habel/Rollinger/Schmidt/Schneider 1980) can be interpreted as a 'symbolic language for describing formal theories' as developed by Kalish/Montague (1964, pp. 271). As said above we have one further class of relevant entities in our 'formal theory': the inference rules. Thus we hope to have a more adequate semantic representation than with purely logical structures.

4. The role of the components and their interaction

In Langendoen's approach the grammar of a natural language consists of six components - each of them being a formal grammar - namely the phonological, semantic, morphemic, word-formation, syntactic, and textual components. In contrast to the usual definition of phrase-structure grammars Langendoen's components have the

[1] This is an interpretation in which each operator is connected with a set of inference rules - and these inference rules, logical and extralogical, define the semantics of the operator.

following pecularities: instead of a single starting symbol we have a set of starting symbols (called axioms); in addition some components have a non-finite set of terminal symbols, i.e. an infinite terminal alphabet, and some components have an infinite set of rules, too. Both generalizations are not new (in the theory of formal systems). As the infinite set of rules is given by finite specifications, this set of rules can be seen as a set of rules "in intensio". Therefore the components can obviously be interpreted as axiomatic systems in the sense of Carnap. As each component is an axiomatic system, the Langendoen grammar is a system of axiomatic systems: the theorems, i.e. the output, of some systems are used as the alphabets, i.e. the input of other systems. Regarding the cooperation of such different axiomatic systems the question arises how this cooperation works.

Question 3: In what way do the components (i.e. the axiomatic systems) of the Langendoen grammar cooperate?

This question is very important since in the Langendoen approach only one kind of relation between the components is given: the interaction by the principle "the outputs of one (or more) system/s/, i.e.theorems, are other systems' inputs, i.e. alphabets". In Artificial Intelligence "cooperating systems", particularly such exchanging information between syntactic and semantic components, have been successful.[1] We doubt that the rules of the syntactic and the textual components are so powerful that the semantic representation (or the meaning) of larger linguistic entities can be computed from input information alone. We suggest a structure of a grammatical system, i.e. of a grammar, in which all (or most of the) components cooperate and communicate with the others in all states of the generating or analyzing process.

[1] Compare similar remarks in Kintsch's discussion of Petöfi's levels of representation and - in general - in Schank's work on a semantics-based, i.e. integrated, parsing process.

A further crucial point of the Langendoen approach is the status of the systems used: the components are generative, i.e. enumerating, systems, as they are axiomatic systems or formal grammars. Therefore the Langendoen grammar is a formal system which enumerates texts (see below) of a natural language, which means that pairs of phonetic and semantic structures are generated. Langendoen's paper says nothing about the problem of allocating for example meanings (or semantic structures) to phonetic structures.

Question 4: How can we use a Langendoen grammar for natural language text analysis? How do we deduce meaning from a string of phonemes or graphemes?

The crux of this problem is that in general the analyzing problem of languages is much more complicated than the synthesizing problem, a fact that is well known in artificial intelligence and computer science. As this problem can be very involved, even for a synthesis grammar, we are sure that the problem will be much harder to solve by a Langendoen grammar as this is a system of complex grammars. As mentioned above, we suggest the concept of cooperating and communicating systems for the analysis of natural-language texts.

5. What is a language? What is a text?

Langendoen's suggestion to define languages as sets of texts is not very different from Chomsky's point of view, defining languages as sets of sentences. Both definitions are based on the same idea: "Languages are sets of entities of a specified kind." The difference between the two definitions of 'language' (Langendoen vs. Chomsky) is caused only by the characterization of the kind of entities, i.e. the members of the set that is the language. The main difference between sentences and texts in the Langendoen approach is that different kinds of categories, i.e. of nonterminal symbols, are used to mark the pair of phonetic and semantic structures. The important question 'How can the

relationship between phonetic and semantic structures be computed' is independent of this difference; we think that for this problem the difference between texts and sentences, as seen by Langendoen, is of no importance.

Since there is no further characterization of 'text' in Langendoen's paper, particularly no relation to an explicandum that is explicated in Langendoen's theory by the theoretical entity 'text', we can say only "texts are the output of the textual component". And from this follows the only characterization of language that we have found in Langendoen's approach. The danger of a definitorial circle between the grammar and its output cannot be overlooked.

One further relevant difference between sentences and texts was made by Hajicová during the discussion: At the level of 'sentence vs. utterance' there is a dichotomy 'possible vs. actual'. The sentences of a language are entities that are possibly used by speakers of the speech community (cf. below), but utterances are actually uttered by someone. It is not possible to speak about texts which were never used.

Last but not least: we are not convinced that there are no higher linguistic units than texts. What is a discourse? Is it one text generated by more than one speaker? Or is it a linguistic entity higher than texts? This problem depends on the following:

6. The speaker-listener: Where have all the language users gone?

We will conclude our comment by one essential objection to Langendoen's paper, namely that we miss the speaker-listener, i.e. the human who communicates by natural language, in the Langendoen approach. Language generated by a Langendoen grammar is a theoretical construct without any connection to the language use of the speaker and the listener of a speech community.

At the level of sentence-grammars (by this we will refer to a generative grammar of the Chomsky-paradigm) there is the well-known relation between the grammar of a language and the competence of the speaker-listener: The sentences of the language, which are generated by the grammar, can be uttered and understood by the speaker-listener because he has the competence with regard to this language. 'Can' and 'competence' reflect the possibility-side of the sentence-utterance dichotomy (see above).

Question 5: To what ability of the speaker-listener does a grammar of the Langendoen type correspond?

The crux of this question is that texts are actual entities (see above); similar questions can also be directed against other types of so-called "text grammars".

If a text grammar corresponds to a speaker's competence for producing and understanding texts, then discourses (with more than one speaker) cannot be texts; but if discourses are texts, what does a text grammar correspond to? As we have found that there exist sentence pairs in natural language (e.g. in German) which are acceptable only if the two sentences are uttered by different speakers and not by the same speaker (and vice versa), this is a further argument that the correspondence between text grammar and human abilities is somewhat odd.

As we remarked above we require a grammar to provide the basis for a model of human communication and verbal interaction. Therefore, in a grammar we must find all the theoretical and practical preconditions of a model of human language understanding. Again the assignment of meanings to utterances is the central problem.

Question 6: What relationship exists between grammars as theoretical constructs and the verbal behaviour of human beings?

This last question can be seen as the problem of the psychological reality of grammars. Our suggestion can be directly deduced from our considerations above, namely that computer simulation of verbal behaviour, particularly text understanding in the communication process, should be a main goal of linguistic inquiry.

7. Final remarks

The interdisciplinary area of cognitive science which includes linguistics, artificial intelligence and psychology will be important for applied linguistics in future. Our questions and comments on Langendoen's paper and our suggestions in this paper refer to problems which have to be solved in all approaches of text representation and understanding. The solution of these problems is a precondition for any applicable system of text understanding.

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Östen Dahl

Department of Linguistics, University of Stockholm

I would like to concentrate here on L's concept of 'textual subordination', since it seems central to what he has to say. L provides two kinds of examples of 'textual subordination'. In the first type, a noun phrase is said to be subordinate to a preceding sentence, e.g. (1).

(1) I put the can on the shelf. The one with the blue label.

In the other, a sentence is said to be textually subordinate to a preceding sentence, e.g. (2).

(2) Although English syntax in the spoken language has been described in detail, not much has been said about the critical differences between the structures of the spoken and written languages. Nevertheless, we have to develop the student's awareness of the syntax of written English, since sooner or later the student will find himself reading a kind of English that no one speaks.

I want to argue that (a) it is not clear that these two texts exemplify phenomena of the same nature (b) that it is rather dubious whether the label 'textual subordination' applies very well to any of them.

Let's take (1) first. It seems to me that we are dealing here with a borderline case between sentential and textual phenomena. Notice that there are very similar constructions which are orthographically one sentence:

(3) I put the can - the one with the blue label - on the shelf.

(4) I put the can on the shelf - the one with the blue label.

In spoken language there would be little to tell us that (1) is fundamentally different from (3) and (4).

L points out that (5) is not well-formed.

(5) *Love is blind. The one with the blue label.

He says that 'the phrase the one with the blue label can be subordinate in an English text to any sentence that is, roughly speaking, about a physical object with a solid surface' and that 'the semantic property of "aboutness" holds of a sentence as a whole'. This is a bit misleading, since the restriction is rather that there must be a noun phrase in the sentence to whose referent the description the one with the blue label may apply. There is thus a relation not only between the sentence and the 'textually subordinate' phrase but also one between that phrase and a noun phrase

in the sentence. This relation may have an overt syntactic manifestation. In a case language such as Russian, the 'satellite' noun phrase must be in the same case as the one it corresponds to in the sentence, e.g.

(1') Ja postavil banku na polku. Tu s sinym jarlyčkom.
'I put the can (acc.) on the shelf. That (acc.) with the blue label'.

In this way, such a 'textually subordinate' noun phrase behaves just like any noun phrase in appositive position, e.g.

(6) Ja videl Ivana, brata Eleny
'I saw Ivan (acc.), brother (acc.) of Elena'

It seems to me that this shows that what we are dealing with here is an extreme case of extraposition of noun phrases, and that these constructions are in many respects more like sentences than like texts.

As for (2), L claims that it is the word nevertheless which marks the subordination. I agree that nevertheless connects the sentence it introduces with the preceding text, but I fail to see that there are any very good reasons for regarding the relation between that sentence and the preceding one as one of subordination. Note that a word like nevertheless does not always mark a relation between a sentence and its immediate predecessor: it also happens that it puts the following sentence in contrast to a longer section of the preceding text. Consider the following quotation from the preface of Chomsky's Aspects of the Theory of Syntax:

(8) 'The idea that a language is based on a system of rules determining the interpretation of its infinitely many sentences is by no means novel. Well over a century ago, it was expressed with reasonable clarity by Wilhelm von Humboldt in his famous but rarely studied introduction to general linguistics (Humboldt, 1836). His view that a language "makes infinite use of finite means" and that its grammar must describe the processes that make this possible is, furthermore, an outgrowth of a persistent concern, within rationalistic philosophy of language and mind, with this "creative" aspect of language use (for discussion, see Chomsky, 1964, forthcoming). What is more, it seems that even Panini's grammar can be interpreted as a fragment of such a "generative grammar", in essentially the contemporary sense of this term.

Nevertheless, within modern linguistics, it is chiefly within the last few years that fairly substantial attempts have been made to construct explicit generative grammars for particular languages and to explore their consequences.'

Maybe Langendoen can amend his grammar to generate also such texts - or maybe it even generates them already, it is not quite clear to me whether it does or not. But that is not the main point: contrary to Langendoen's, my intuitive powers make me sceptical about assuming a relation of subordination in (2), and it seems to me that it is even more counterintuitive to do so in (9).

I have said that I agree that nevertheless connects a sentence with what precedes. I think that the connection that is involved here is an anaphoric relation. As some support for this one may point to the fact that many expressions which are more or less functionally equivalent to nevertheless contain an overt anaphoric pronoun. Cf.

(9) In spite of all this
    These facts notwithstanding , we have to ....
    Nevertheless

It could of course be argued that all anaphoric intersentential connections should be analyzed in terms of textual subordination. Personally, I find such a treatment highly counterintuitive. Among other things, notice that we can have a chain of anaphoric relations between subsequent pairs of sentences, e.g. like this:

If anaphoric relations are treated as textual subordination, we should have to assume a nested structure of the following kind:

$S_1 \quad (S_2 \quad (S_3 \quad (S_4))$

At least from a psychological point of view, such an assumption seems rather unrealistic.

REPLY

D. Terence Langendoen

I restrict my comments in this reply to the discussion by Habel and Schneider, since I have already responded to Dahl's comments in the revised version of my paper.

1. Potential and actual texts

Habel and Schneider, following a suggestion by Hajičová, contend that "it is not possible to speak about texts that were never used". I disagree. At any given moment, there is some finite number n of extant texts (including and perhaps limited to unrecorded oral productions) in a given language. How is membership in this set determined? Certainly not by fiat -- not everything that purports to be a text in a given language is ipso facto a text in that language. Each must satisfy certain criteria of well-formedness. Such criteria are satisfied not only by the n extant texts; they are also satisfied by innumerably many nonextant ones, and of course they also fail to be satisfied by innumerably many other objects, both extant and nonextant. The purpose of text theory is to lay down the criteria of well-formedness for texthood in a given language, not to provide an exegesis of extant texts. The latter is the purpose of textual criticism.

2. The speaker-hearer's knowledge of text membership

Given that there are possible, but uninstantiated, texts in a given language, we may, if we wish, impute knowledge of the criteria for text membership to native speaker-hearers of that language, just as we conventionally impute knowledge of the criteria for sentencehood to them. Although Habel

and Schneider "miss" the speaker-hearer in my approach to text analysis, she's there, in exactly the same role she plays in less unorthodox generative theories of language.

3. Semantic representations and logical relations

Habel and Schneider express concern about the proper form of semantic representation and about my lack of specificity concerning that form. They advocate a program of extending formal logic to include operations that deal with certain substantive, and traditionally nonlogical, relations among the phrases, sentences, and texts of a language. But as my colleague Arnold Koslow has shown in unpublished work, a great deal can be learned about the logical relations among linguistic constructs by simply considering the entailment relations among them without concern for their form. For example, given a characterization of what it is for one sentence to be the negation of another, we can determine whether the negation of the negation of a sentence is logically equivalent to the original sentence. The answer does not depend on the form of the original sentence, nor of the negation operator, nor on the presence or absence of any particular formative, but does depend on the entailment relations among all of the sentences of the set of sentences under consideration. Similar remarks apply to the analysis of the logical properties of linguistic relations, such as symmetry, reflexivity, and reciprocity. While I endorse, in my paper, the form of semantic representation that Katz has developed, nothing of significance in my paper hinges on that endorsement. I suspect that "the inferential processes of man" can operate successfully on any of an enormous variety of types of semantic representation.

Why should we have to commit ourselves now to any particular one?

4. Formalizing vs. operationalizing linguistic theory

The formalizing and operationalizing of linguistic theory are distinct goals and shold not be confused. While my theory of text analysis is undoubtedly formal, it is moot whether it is operationalizable. That is, given some system, it may not be possible to determine in a reasonable amount of time, or ever, whether that system is a grammar in the sense I have defined it. Moreover, given a grammar, it may not be possible to determine in a reasonable amount of time, or ever, all of its properties, such as what the set of texts is that it enumerates. Nevertheless it may be possible to determine in reasonable time, using a computer or some other tool, certain of the properties of a grammar of the sort I envision, particularly those having to do with relatively simple linguistic constructs. Such an achievement I think is the most that anyone could reasonably demand, as it would provide a basis for the simulation of human use of linguistic knowledge. On the other hand, the failure of my theory of grammar as a whole to be operationalizable does not strike me even as a shortcoming, much less as a serious one.

5. Text theory vs. text understanding

The goal of developing text-understanding systems is also distinct from that of developing text theory. In fact, to develop text-understanding systems in the absence of a well-informed theory of text structure would be completely misguided. How are people working on a text-understanding system to know,

for example, that the meaning of a sentence in a language does not change in a larger linguistic context, unless they are guided by a theory of text structure that informs them of that fact? For certainly one's initial impression is otherwise; given the two texts (1) and (2), one would surely be tempted to conclude that the two occurrences of the sentence He just came from Stockholm have different meanings:

(1) A: Does he want to go to Stockholm?

B: He just came from Stockholm.

(2) A: Why does he look so overwhelmed?

B: He just came from Stockholm.

But the conclusion is false; the two occurrences of the sentence have exactly the same meaning. The fact that its occurrence in (1) counts as a negative answer to A's yes-no question is a property of the text (1) as a whole, not of either of its constituent sentences; similarly the fact that its occurrence in (2) answers A's why-question is a property of the txt (2) as a whole, and not of either of its constituent sentences.

6. Discourses as texts

As the examples just given and in the body of my paper illustrate, discourses involving more than one speaker can certainly be texts. I have no idea why Habel and Schneider consider that if the textual component of a grammar corresponds to a speaker-hearer's knowledge of text structure, such discourses cannot be texts. Surely no one is troubled by the fact that one can understand a sentence that is started by one speaker and concluded by another, and that one can both complete someone else's partial sentence and recognize that someone else has completed

the sentence one has started. Why should the understanding and producing of discourses be any more problematic?