

The accumulation of formalized observations on French and other languages<sup>1</sup>, has led to the view that the elementary unit of meaning is not the word but the simple sentence, that is, a sequence subject-verb-possible object complement(s). Accordingly, our research deals with the lexicon-grammar of a language, rather than with its lexicon, traditionally defined as a more or less structured set of words.

The framework of description we adopt is essentially Z.S. Harris' theory of transformational grammar. The view we take is supported by the category of verbs in an obvious way: It is not possible to deal with the meaning of a verb without using for its interpretation its subject and its complement(s). The situation is not as clear for the other parts of speech, although there are many well-known phenomena that suggest one can extend our hypothesis:

— adjectives; predicative adjectives are often compared to verbs by means of the formula

$$be \text{ Adjective} = \text{Verb}$$

— adverbs; a way of distinguishing the two types of adverbs found in

*Bob boldly stood up*

*Bob unfortunately stood up*

is by expressing that *Bob* is the subject of *bold(ly)*, and that *Bob's standing up* is the subject of *unfortunate* (e.g. Z.S. Harris 1964). In other words, the interpretation of such adverbs has a sentential component.

— nouns; it is perhaps to nouns that the application of our hypothesis is the least obvious. However, traditional distinctions such as action nouns as opposed to concrete nouns can be viewed as an indication that the former have some sentential meaning.

We will present classes of phenomena that justify our viewpoint, and that at the same time exemplify the structure of the lexicon-grammar.

### 1. *Simple sentences and sentential relations*

We consider that sentence shapes are related to each other in a formal way. Consider for example, the sentences

<sup>1</sup> Cfr. Elia [1978; 1979]; Elia, Martinelli, d'Agostino [1981]; Lamiroy [1981]; Malaca Casteleiro [1981]; Maceido de Oliveira [1979; 1981]; Chai-Song [1982]; Rabenilaina [1979]; Subirats [1981]; Treig [1977].

- (1) *One has observed that Saturn has hundreds of rings*
- (2) *That Saturn has hundreds of rings has been observed*
- (3) *That Saturn has hundreds of rings can be observed*
- (4) *It has been observed that Saturn has hundreds of rings*
- (5) *That Saturn has hundreds of rings is observable*
- (6) *That Saturn has hundreds of rings is an observation*

This set of sentences is structured by the following equivalence relations<sup>2</sup>:

- (1) = (2) is the Passive relation;
- (2) = (3) is Auxiliary insertion;
- (2) = (4) is the Extraposition relation;
- (3) = (5) is an adjectivization relation;
- (2) = (6) is a nominalization relation.

The relations are not oriented, hence they are noted by the sign "=". The declarative sentence (1) is taken as the representing element of the equivalence class (1)-(6). We will write for the structure of (1):

$$N_0 V N_1, N_0 =: one, N_1 =: that S$$

the symbol "=: " is used to specify, either lexically or structurally, the content of a given form. Numerical subscripts are attached to the various noun phrases of a sentence, in order to refer to them. For example, in a transformational relation such as Passive, we write

$$\begin{aligned} & N_0 V N_1 Prep N_2 \\ = & N_1 be V_{pp} by N_0 Prep N_2 \end{aligned}$$

*Prep N<sub>2</sub>* is here a second prepositional complement.

One of the problems that arise when dealing with simple sentences consists in separating «essential» complements from circumstantial ones. This is a classical problem in traditional grammar and in generative grammar as well. The approach that has been adopted for the current verbs of French (about 9,000 verbs) corresponds roughly to the following ordered criteria:

Step 1) all obligatory complements are retained.

<sup>2</sup> We will not concern ourselves with the numerous elaborate proposals that have been made for the form of these relations. Our discussion merely supposes that relations exist among the given sentence forms.



Step 2) only three forms of (optional) complements are being considered: direct complements, and complements with the preposition *à* or *de*. The rationale behind this choice is that these complements are linked to the pre-verbal or so called clitic pronouns.

Step 3) the notion of object complement is defined in terms of the shape of the associated interrogative pronouns. Thus, direct objects correspond to the pronouns *qui* (*who*) and *que* (*what*).

This criterion, when applied to the following three sentences of the form  $N_0 V N_1$  permits only the first one to be considered as containing an object:

*Bob a mangé tout un gâteau*  
(Bob ate a whole cake)

*Bob a dormi toute la nuit*  
(Bob slept the whole night)

*Bob a dormi ce côté du mur*  
(Bob slept this side of the wall)

These strictly syntactic criteria apply to all French verbs; as a first approximation, they provide a satisfactory picture of the complement system of French verbs. There are however extensions that substantially improve this preliminary description.

Consider the sentence

(7)  $N_0 V N_1 de N_2 =:$

*Bob a chargé le camion de quatre lourdes caisses*  
(Bob loaded the truck with four heavy boxes)

According to our criteria, *le camion* is a direct object and *de quatre lourdes caisses* is an indirect object. But the sentence (7) enters into the relation:

(7)  $N_0 V N_1 de N_2 =$  (8)  $N_0 V N_2 Loc N_1 =:$

*Bob a chargé quatre lourdes caisses (dans, sur) le camion*  
= (Bob loaded four heavy boxes on the truck)

Here, *quatre lourdes caisses* has become a direct object, and *le camion* a locative complement, with a preposition (*Loc*) that determines the form of the interrogative pronoun *où* (*where*). This situation does not affect our preliminary description, since transformations and other relations among sentences are known to introduce a variety of grammatical constants. But consider now the sentence

(9) *Bob a rangé quatre lourdes caisses (dans, sur) le camion*  
(Bob stored four heavy boxes on the truck)

It has a interpretation<sup>3</sup> similar to that of (8). Sentence (9) has no counterpart where *le camion* would be a direct object:

\* *Bob a rangé le camion de quatre lourdes caisses*  
 (\* *Bob stored the truck with four heavy boxes*)

Obviously the role, semantic and syntactic, of *Loc le camion* is the same in (9) and (8), but our procedure leads us to describe (9) with the structure  $N_0 V N_1$ , that is, we are forced to leave out the second complement as nonessential. Such a description is undesirable, and *ranger (to store)* should have the same description as *charger (to load)*, namely with two essential complements.

In such cases, we must have recourse to a rule of analogic extension:

(9), being analogous to (8), is described in the same way as (8). [Harris, 1964].

This principle applies in different situations. Thus, by step 1 above, we included obligatory complements as essential complements. For example in

*Max compte sur Bob*  
 (*Max counts on Bob*)

The obligatory complement *sur Bob* is incorporated in our description (e.g.  $N_0 V \text{ sur } N_1$ ). But, when independently we describe the sentence

*Cette remarque a agi sur Bob*  
 (*This remark had an effect on Bob*)

we have to classify *agir (to have an effect)* as intransitive (e.g. with structure  $N_0 V$ ), since the optional prepositional complement is excluded by step 2. However, by the principle of analogic extension, we will describe *agir* with structure  $N_0 V \text{ sur } N_1$

Notice that the notion of analogy applied to obligatory complements is consistent with the notion of analogy applied to «secondary» complements as in examples (8)-(9). Consider the sentence

$N_0 V N_1 \text{ Loc } N_2 = :$

(10) *Bob a mis quatre lourdes caisses (dans, sur) le camion*  
 (*Bob put four heavy boxes on the truck*)

Its second complement is obligatory:

<sup>3</sup> The place complement is ambiguous: there can be movement of the boxes «onto» the truck, or else, the platform of the truck can be the scene of manipulations of the boxes.



$$N_0 V N_1 =:$$

\* *Bob a mis quatre lourdes caisses*  
 (\* *Bob put four heavy boxes*)

Hence, the verb *mettre* (to put) must be described with an essential locative complement. Sentence (10) has no related form such as

$$N_0 V N_2 Loc N_1 =:$$

\* *Bob a mis le camion de quatre lourdes caisses*  
 (\* *Bob put the truck with four heavy boxes*)

Now, if we return to sentence (9), we can also consider that it is an analogic extension of (10). Thus, the locative complement in (9) is an analogic extension in two independent situations, which is an indication of the coherence of the choice made. This formal situation acts as a constraint on the intuitive character of the notion of analogy. In this way, we avoid a purely intuitive notion of analogy that might lead to arbitrary decisions about the nature (essential or not), of circumstantial complements.

Thus, an operational procedure has allowed us to describe all the sentences of French with their essential complements.

An enumeration of the verbs according to their representing structure is given in table 1 (Gross, 1975; Boons, Guillet, Leclère 1976a; 1976b; 1982].

TABLE 1.

$N_0 V$	1.200
$N_0 V N_1$	3.500
$N_0 V \dot{a}N_1$	300
$N_0 V deN_1$	300
$N_0 V N_1 N_2$	100
$N_0 V N_1 (\dot{a}N_2 + Loc N_2)$	2.300
$N_0 V N_1 de N_2$	1.300
$N_0 V \dot{a}N_1 \dot{a}N_2$	3
$N_0 V \dot{a}N_1 de N_2$	10
$N_0 V de N_1 de N_2$	1?
TOTAL	> 9.000

Several observations on the structure of the lexicon-grammar can be made from this table:

(a) No verb has three essential complements or more<sup>4</sup>

(b) Verbs with two prepositional complements are exceptional

Although various questions are still pending, we consider these observations as fairly general: (a) sets a size limit on the structure of simple sentences, and (b) provides a constraint on the shape of simple sentences.

## 2. *The frozen component of the lexicon-grammar*

Frozen or idiomatic expressions play an important role in the lexicon; they can be classified by using the traditional parts of speech:

— compound nouns can be viewed as idiomatic, in the sense that their meaning cannot be constructed from their elementary parts. Technical expressions are frozen compounds, they are highly productive and constitute the bulk of the lexical entries:

*melting pot, cash register, random access memory,  
risk assessment*

— idiomatic adverbs such as

*à gorge déployée (loudly), by hook and by crook*

are more numerous (in French) than the so-called regular ones that are formed by suffixing *-ment(-ly)* to an adjective. Their range of meaning is quite restricted, for they are mostly adverbs of intensity;

— idiomatic simple sentences are directly comparable in form with the free sentences we discussed in the previous section<sup>5</sup>. Hence, idiomatic sentences are described as structures

$$N_0 V N_1 Prep N_2$$

where the frozen positions are noted  $C_i$  instead of  $N_i$ . Thus we have

$$N_0 V C_1 Prep C_2 =: Ben \text{ took the bull by the horns}$$

$$N_0 V C_1 =: Bob \text{ laid down his arms}$$

$$N_0 V Prep (N's C)_1 =: Bob \text{ ate out of Ben's hand}$$

In the last example, the complement delimited by indexed parentheses is

<sup>4</sup> There might be a few exceptions, such as

*Il a suffi(à Bob) (d'un doigt) (pour tenir la porte)*  
(It took Bob one finger to hold the door)

with three obligatory complements; but here, there is a possibility that *un doigt* is extraposed from the subject position.

<sup>5</sup> Expressions with auxiliaries or support verbs such as *être (to be)*, *avoir (to have)*, *faire (to make)* are the subject of separate studies [Danlos, 1980; Giry-Schneider, 1978; Gross, 1982; Labelle, 1974; 1983]. Corresponding counts are not included here.



composed of a frozen noun *band* with an obligatory free noun complement (here *Ben*).

Frozen sentences have been systematically classified according to their syntactic properties. Numerical results are summarized in table 2.

TABLE 2.

C1	$N_0 V C_1$	<i>Il a loupé le coche</i>	2.050
CAN	$N_0 V (C \text{ à, de } N)_1$	<i>Cela a délié la langue de Max (= lui)</i>	400
CDN	$N_0 V (C \text{ de } N)_1$	<i>Il bat le rappel de ses amis</i>	350
CP1	$N_0 V \text{ Prép } C_1$	<i>Il charrie dans les bégonias</i>	1.150
CPN	$N_0 V \text{ Prép } (C \text{ de } N)_1$	<i>Il abonde dans le sens de Max</i>	150
C1PN	$N_0 V C_1 \text{ Prép } N_2$	<i>Il a déchargé sa bile sur Max</i>	1.500
CNP2	$N_0 V N_1 \text{ Prép } C_2$	<i>Ils ont passé Max par les armes</i>	1.200
C1P2	$N_0 V C_1 \text{ Prép } C_2$	<i>Il met de l'eau dans son vin</i>	600
C5	$(Qu P)_0 V \text{ Prép } N_1$	<i>Que Max reste milite en sa faveur</i>	100
C6	$N_0 V Qu P \text{ Prép } C_2$	<i>Il a pris du bon côté que Max reste</i>	200
C7	$N_0 V C_1 \text{ à ce } Qu P$	<i>Il a dit non à ce que Max reste</i>	100
C8	$N_0 V C_1 \text{ de ce } Qu P$	<i>Il se mord les doigts de ce qu'il est resté</i>	200
CADV	$N_0 V Adv$	<i>Cela ne pisse pas loin</i>	150
CX	$N_0 V X$	<i>Il est parti sans laisser d'adresse</i>	70
C0	$C_0 V \Omega$	<i>La moutarde monte au nez de Max</i>	600
A1	$N_0 \text{ avoir } C_1$	<i>Il a eu le mot de la fin</i>	50
A1PN	$N_0 \text{ avoir } C_1 \text{ Prép } N_2$	<i>Il a barres sur Max</i>	70
ANP2	$N_0 \text{ avoir } N_1 \text{ Prép } C_2$	<i>Il a Max en horreur</i>	50
A12	$N_0 \text{ avoir } C_1 Adj_1$	<i>Il a la vue basse</i>	70
A1P2	$N_0 \text{ avoir } C_1 \text{ Prép } C_2$	<i>Il a mal aux cheveux</i>	150
E01	$C_0 \text{ de } N \text{ être } Adj$	<i>La barbe de Max est fleurie</i>	200
E0P1	$C_0 \text{ être } \text{Prép } C_1$	<i>Les rieurs sont du côté de Max</i>	100
TOTAL			9.510

By comparing tables 1 and 2, we see that the frozen component is comparable in size to the free component. As a matter of fact, we suspect the frozen part to be considerably larger.

Here also, we have observed an empirical upper limit of two complements. We found no case with three frozen complements. A small number of cases involving a mixture of frozen and free complements of length 3 were observed but most of them could be interpreted as including an adverbial complement.

It should be emphasized that the criteria for retaining frozen sentences are mainly semantic: impossibility of constructing meanings from the words and their syntactic relations, absence of distributional properties. One formal criterion plays an important role: frozen complements are obligatory in most cases. Thus, the limit of 2 is confirmed in an independent way.

### 3. Support verbs

The various parts of speech are not disconnected; traditionally, they are related in the morphological component of the grammar. But we will take here a different stand on these relations [Harris, 1964; Dubois, 1967: 130-131; Gross, 1976, Giry-Schneider, 1978b], and we will deal with them in a strictly syntactic fashion. We present examples of syntactic relations that link the various parts of speech, thus increasing the structure of the lexicon. These relations involve verbs that play an auxiliary role, such as *to be*, *to have*. We call these verbs support verbs.

Relations such as the following affect large numbers of lexical items:

#### 3.1. Verb-adjective

*Cette histoire amuse Max*  
(This story amuses Max)  
= *Cette histoire est amusante pour Max*  
(This story is amusing to Max)  
(M. Gross 1975, Lakoff 1970)

*The garden swarms with bees*  
= *The garden is aswarm with bees* (Salkoff 1983)

#### 3.2. Verb-noun

*Max a complimenté Bob*  
(Max complimented Bob)  
= *Max a fait des compliments à Bob*  
(Max paid compliments to Bob)  
(Giry-Schneider 1978b)

*Max respecte Bob*  
(Max respects Bob)  
= *Max a du respect pour Bob*  
(Max has respect for Bob)

*Cette loi contredit nos règles*  
(This law contradicts our rules)  
= *Cette loi est en contradiction avec nos règles*  
(This law is in contradiction with our rules)  
(Negroni-Peyre 1978)



(11) *Max est sincère*  
 (*Max is sincere*)

(11a) = *Max a une certaine sincérité*  
 (*Max has a certain sincerity*)  
 [Meunier, 1977; 1981]

These relations do not exclude each other and one finds syntactic paradigms such as

*Max respecte (Bob, la loi)*  
 (*Max respects (Bob, the law)*)  
 = *Max a du respect pour (Bob, la loi)*  
 (*Max has respect for (Bob, the law)*)  
 = *(Bob, la loi) a le respect de Max*  
 ((*Bob, the law*) (*has, holds*) *Max's respect*)  
 = *Max est respectueux de (Bob, la loi)*  
 (*Max is respectful of (Bob, the law)*)

Depending on the terminology, we can consider such sentences as representing new voices of the verbs: nominal and adjectival voices, or else they can be viewed as transforms of each other or as all derived from one deep structure, or from an abstract logical form that does not concern us.

Such syntactic paradigms can be reduced to one line, since some verbs, nouns or adjectives have no derived form. Thus *idée* — *idea* in

*Max a une idée (sur ce texte)*  
 (*Max has an idea (about this text)*)

is combined with the support verb *avoir* — *to have*. Here too, the entry of the lexicon grammar is not the noun, but the sentence built up by means of the support verb.

### 3.4. *Adverbs*

Some of the relations link adjectives and adverbs, as in:

*That Max accepted the rule was unfortunate*  
 = *Max accepted the rule unfortunately*

Harris [1964; 1976] has extended such relations to other support verbs than *to be*.

Other pairs are of the type

*Max accepted the rule with sincerity*

*Max accepted the rule sincerely*

Their analysis appears to involve the relation discussed above: (11a) = (11); the support verb *to have* underlies the preposition *with* in a general way.

The lexical coverage of all these relations, although not fully known, appears to be quite high. Elements that cannot be treated directly in terms of sentential relations should be mainly limited to frozen expressions. Thus, large scale empirical observation confirms our hypothesis about the nature of the lexicon.

### 3.5. Concrete nouns

Concrete nouns such as *oak*, *gardener*, etc. constitute an important class of lexical items that we have not yet discussed. It is harder to conceive a basic sentence that would characterize their use. There are nonetheless reasons to include concrete nouns in basic sentences.

Thus, along with Z.S. Harris [1968], we will describe distributional properties (or cooccurrence, of selectional restrictions) in the following way.

Consider the verb *to prune*; in one of its meanings, it takes *tree* as an object:

*Bob pruned the trees*

We consider *tree* as a basic or internal object<sup>6</sup> of *to prune*. This sentence is put into correspondance with the element of the lexicon-grammar:

(12) *A person prunes a tree*

where *person* is a basic or internal subject.

The element (12) carries the basic information.

Now, consider the sentence

(13) *The new gardener prunes an oak*

we derive (13) from (12) by introducing first the classificatory sentences

(14) *The new gardener is a person*

(15) *An oak is a tree*

<sup>6</sup> A given verb may have several such objects. For example, *shrub* could be another object of *to prune*. A free verb can also have a frozen object; this is the case for *the boat* in *Bob missed the boat*; the noun *boat* appears to belong to the regular distribution of *to miss* (e.g. *Bob missed an opportunity*).



which, after definitization, will be combined with (12) by relativization:

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(16) *A person who is the new gardener  
prunes the three which is an oak*

By reduction of (16), that is by WH-IS deletion and by redundancy removal of the internal subject and object, we obtain (13).

The sentences (14) and (15) are indeed a model for simple sentences containing concrete nouns:

Such classifier sentences describe the extra-linguistic universe, they carry a supplement of information that can be added to the other simple sentences. These classificatory sentences are also part of the lexicon-grammar.

Other types of generic sentences will also involve concrete nouns:

*A person has two eyes*

*A drum makes sounds*

and in many cases, syntactic forms and interpretations have to be described by means of such elements:

— in French, nouns that correspond to parts of the human body, such as *eye*, *foot* often have special syntactic properties;

— phrases such as *the sound of a drum* will be described with the underlying support verb *to make*; etc.

#### 4. Operators

So far, we have discussed simple sentences. By means of operations such as relativization and coordination, complex sentences can be built up. But there are sentences of intermediary complexity that seem to require some type of lexical decomposition. This is the case for many sentences with two complements, that is, of the form

$N_0 \ V \ N_1 \ Prep \ N_2$

where one observes relations between the  $N_i$ 's. Causative sentences such as *Bob made Max leave* are obviously of this type, with a subject relation between *Max* and *leave*.

Other form with two complements are:

*Bob proposed some help to Max*

where *Bob*, subject of *to propose*, is also the «subject» of *help*, and *Max*, the dative complement of *to propose*, is the «object» of *help*.

Other form with two complements are:

17) *This solution (has, keeps) an advantage in its favour*

*Bob (has, keeps) an advantage in his favour*

where the possessive adjective must refer to the subject. They are related to sentences with one complement:

- (18) *The advantage is in favour of this solution*  
*The advantage is in Bob's favour*

A way to analyse (17) is by applying the binding operators  $N_0$  (*have*, *keep*) to (18) [Gross, 1981].

The part of the lexicon-grammar that corresponds to such complex forms makes explicit structures on simple sentences that are syntactically and semantically related. Seemingly simple sentences can thus be seen as decomposed into simpler ones.

Another way of relating elements of the lexicon-grammar is by means of an operation called fusion. Consider the sentences

- (19)  $N_0 V N_1 \text{ out of } N_2 =:$   
*Bob scared Max out of the room*  
*Bob tricked Max out of the room*

They do not correspond to the structure and meanings found in the standard use:

- (20)  $N_0 V N_1 =:$   
*(Bob, this story) (scared, tricked) Max*

They have acquired the structure and meaning of a verb such as *to get* in:

- (21)  $N_0 V N_1 \text{ out of } N_2 =:$   
*Bob got Max out of the room*

The operation of fusion<sup>7</sup> consists in deriving (19) from a combination of (19) and (20):

- (22) *Bob got Max out of the room by (scaring, tricking) him*

The operation of fusion replaces the verb *to get* by the verbs *to scare*, *to trick*, providing (19).

This analysis allows existing verbs to enter into new structures with a supplement of meaning. In French, large classes of verbs are concerned by it (Gross 1981).

<sup>7</sup> One argument in favour of this analysis is the unacceptability of

\**Bob scared Max out of the room by tricking him*

\**Bob tricked Max out of the room by scaring him*



We have presented a number of elementary structures and relations on them. Our hypothesis is that the core of meaning is represented by such a system.

The large scale study of French currently being conducted at the Laboratoire d'Automatique Documentaire et Linguistique has confirmed the validity of this approach. The 30.000 entries of the lexicon-grammar of French that have been described so far constitute the empirical basis of the system.

Problems remain, mainly for verbs with two complements (§ 4), but all of the examples studied so far indicate that this description can be completed in terms of the devices described here.

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# A TEXT-THEORETICAL ACCOUNT OF QUESTIONS OF LEXICAL STRUCTURE (I)

In the following article we shall deal with some general questions of lexicology from the point of view of text-theory and general semantics.

Our approach is characterized by four assumptions:

- 1) A lexicon (system of lexicons) should be conceived of as a well-defined component of a grammatical theory.
- 2) It should be compatible with a concept of meaning that distinguishes between sense and correlate along the lines of Putnam's semantics.
- 3) It should provide the representation of a structured system of knowledge (embracing linguistic as well as encyclopedic knowledge), and
- 4) it should provide a basis for the context-dependent interpretation of linguistic units of arbitrary length (which may be called texts).

1. In discussing problems of lexical structuring there are — in our opinion — two questions of central importance. Firstly: how should lexical entries be organized; what kinds of informations have to be dealt with; which schema (or schemata) can be accepted as giving the general form(s) of lexical