Translation of the Predicative Element of a Sentence:
category switching, aspect and diathesis

L. Danlos & P. Samvelian*

TALANA - Université de Paris 7
2 Place Jussieu, 75251 Paris Cedex 05, France
e-mail : laurence.danlos@linguist.jussieu.fr

Abstract

To translate collocations such as *prendre une décision, prendre l'habitude, perdre l'habitude, avoir soif,* most MT systems include bilingual rules as *prendre (—* décision) --> *make, prendre (—* habitude) --> *get into, perdre (—* habitude) --> *get out of, soif* (avoir —) --> *thirsty* (be —). These numerous rules, which are lexically context-sensitive, are costly, be they used in a rationalist or empiricist approach. This paper presents a solution where they are avoided. This solution is based on linguistics notions such as "predicative element", "aspectual variant", "diathetic variant" which allow us to use only the unavoidable simple bilingual rules such as *décision --> decision, habitude -•> habit, thirsty --> soif.* This solution, which has been successfully implemented in a rule-based transfer system, i.e. the Eurotra system which handles nine languages, requires a lot of monolingual lexical information, but we will show that this lexical information should be easily extracted from tagged corpora.

0. Introduction

In MT systems, whether they are based on a rationalist or empiricist approach, the translation of collocations such as *avoir l'habitude, perdre l'habitude, prendre l'habitude, prendre une décision* are handled with rules where the translation of the verb is determined by its object[1] :

(1a) *avoir (—* habitude) --> *be in*

(1b) *perdre (—* habitude) --> *get out of*

(1c) *prendre (—* habitude) --> *get into*

---

[1] We assume that the reader knows French and English sufficiently to understand the examples.

(1d)   *prendre (— décision) -->make*

These rules, which are numerous and costly, are either hand-written or extracted automatically from corpora (Brown et alii 1988, 1991). Our purpose is to show that they are unnecessary. We will propose a solution which is centered on the noun of these collocations. This noun is the key element on linguistics grounds, and on statistical grounds, it is the most informative element to the extent that e.g. the chances of observing *make* given *decision* are more important than the chances of observing *decision* given *make.*

Our solution, which relies on thorough linguistic studies exposed briefly below, consists in associating to nouns such as *habitude* or *habit* a set of "support verbs" where each verb is given a "semantic value" (written below within brackets):

habitude —> {*avoir* (neuter), *perdre* (terminative), *prendre* (inchoative)}
habit —>{*be in* (neuter), *get out of* (terminative), *get into* (inchoative)}

The translation of a collocation like *prendre l'habitude* is carried out through the following steps: 1) figure out that *prendre* is one of the support verbs associated with *habitude* and record its semantic value, i.e. inchoative, 2) use the simple transfer rule *habitude --> habit,* 3) search in the set of support verbs associated with *habit* the element with the semantic value recorded in step 1), which brings back *get into.* The solution proposed for translating collocations like *prendre l'habitude* can be extended to handle translation cases which entail a "category switching" like:

(2)   *be snowy --> neiger*
(3)   *be thirsty <--> avoir soif*

The implementation of this solution in a rule-based transfer system, i.e. Eurotra, will be presented. Finally, we will discuss the feasibility of extracting automatically from corpora monolingual lexical information such as the set of support verbs associated with a noun like *habitude* or *habit.* Let us first expose the linguistics basis of our solution.

1 Linguistic data

1.1 Predicative element of a sentence

We assume that a sentence is the projection of the argument structure of a lexical head into a syntactic structure. This head will be called the predicative element of the sentence. We note

Na the first argument of the predicative element, *Nb* and *Nc* a possible second and third argument.

Let us consider four types of predicative elements as illustrated in the following examples:

(4)   *John is reading a book*

(5)   *John is proud of Mary*

(6)   *John has ascendancy over Mary*

(7)   *John is at the mercy of Mary*

The predicative element of these sentences is respectively:

- the ordinary verb *read* in (4) which has the following structure: *Na Vord Nb (Vord* stands for ordinary verb);
- the adjective *proud* (supported by *be*) in (5) which has the following structure: Na *be Adj Prepb Nb;*
- the predicative noun *ascendancy* (supported by *have*) in (6) which has the following structure: Na *Vsup Det Npred Prepb Nb* where the verb is called a "support verb" (noted *Vsup).* It introduces a "predicative noun" (noted *Npred*)[2].
- the sequence *at the mercy* (supported by *be*) in (7) which has the following structure: *Na be Prep X Prepb Nb* where the verb *be* is followed by a preposition (noted *Prep*) and a noun phrase (noted *X*)[3].

In (4) the lexical head of the sentence (i.e. a *Vord)* corresponds to its syntactic head. In the three other examples, the head (which is not a *Vord)* is supported by a verb with which it forms a complex syntactic head. We are going to show that using this notion of semantic head allows us to formalize the contrastive data in a way which is fruitful for automatic translation. These four types of predicative elements are noted: $Pred_i$ with i Σ {Vord, Vsup-Npred, be-Adj, be-PrepX}

A predicative element can be viewed as the lexicalisation of a semantico-logical concept (a notion that we will not attempt to formalize). For example, English *commit-suicide* and French *se suicider* can both be viewed as lexicalisation of the language-free concept SUICIDE. As lexicalisation is a purely idiosyncratic monolingual phenomenon, one can expect that a predicative element of type i is translated into another language as a predicative element of type j with a relation

---

[2] cf Cartel 1984; Danlos 1980,1981, 1988; Giry-Schneider 1978, 1987; Gross 1981; G. Gross 1989; Meunier 1981; Vivès 1984.

[3] cf. Danlos 1980,1981,1988; Samvelian 1990, Samvelian et alii 1992.

between i and j which cannot be predicted. Given the four types of predicative elements we consider here, one can expect sixteen (i.e. 16 = 4^2) cases of translation, and in fact, these sixteen cases are encountered when translating from French to English or from English to French, as illustrated bellow:

Case 1)   Vord->Vord

John is reading a book --> Jean lit un livre

Case 2)   be-Adj --> be-Adj

John is fat --> Jean est gros

Case 3)   Vsup-Npred --> Vsup-Npred

Jean a pris une décision --> John made a decision

Case 4)   be-Prep X --> be-Prep X

John is in good spirits -> Jean est de bonne humeur

Case 5)   Vord --> be-Adj

77» room adjoins the kitchen ~> La chambre est contiguë à la cuisine

Case 6)   Vord --> Vsup-Npred

John ambushed Mary --> Jean a tendu une embuscade à Marie

Case 7)   Vord --> be-Prep X

This theater billed Hamlet --> Hamlet était à l'affiche de ce théâtre

Case 8)   Vsup-Npred --> Vord

Jean a fait un croc-en-jambe à Marie --> John tripped up Mary

Case 9)   Vsup-Npred --> be-Adj

Jean a de la reconnaissance envers Marie -> John is grateful to Marie

Case 10)   Vsup-Npred --> be-Prep X

Jean a des difficultés financières --> John is in financial difficulties

Case 11)   be-Adj --> Vord

It was snowy yesterday --> Il a neigé hier

Case 12)   be-Adj --> Vsup-Npred

John is thirsty --> Jean a soif

Case 13)   be-Adj --> be-Prep X

John is agog about this letter --> Jean est en émoi à cause de cette lettre

Case 14)   be-Prep X --> Vord

Jean est dans l'attente d'une réponse --> John is waiting for an answer

Case 15)   be-Prep X --> be-Adj

Jean est sur la paille   --> John is broke

Case 16)   be-Prep X --> Vsup-Npred

Jean est d'un caractère fermé -> John has a withdrawn nature

The first four cases entail no category switching while the twelve others do. The case (3) *Vsup-Npred --> Vsup-Npred* entails no category switching but a semi-compositional translation (Danlos 1992). The support verb in the target language is determined by the target *Npred* and not by the source *Vsup*.This is due to the fact that monolingually the choice of a *Vsup* depends on the *Npred.* The following translations of the support verb *faire* illustrate this phenomenon:

Jean a fait une promenade --> John took a walk

Jean a fait un résumé de ce livre --> John made a summary of this book

Jean fait la sieste --> John haves (takes) a nap

Jean fait la cour à Marie --> John pays court to Mary

Jean a fait une entourloupette à Marie --> John played a trick on Mary

On the other hand, the translation of *Npred* is compositional in that its translation in a support verb construction is the same as its transition in a noun phrase :

la promenade de Jean --> John's walk

le résumé de Jean de ce livre ~> John's summary of this book

1.2 Aspectual value in a sentence

A sentence may focus on a specific phase of the process or state it denotes. A process or state may have a beginning, a duration and an end. The focus on the beginning is called "inchoative" aspect, as in :

(8a)   *John gains ascendancy over Mary*

(8b)   *John begins to have ascendancy over Mary*

The focus on the end is called "terminative" aspect, as in :

(9a)   *John came out of a coma*

(9b)   *John is not anymore in a coma*

25

The focus on the duration is called "durative" aspect, as in :

(10a)   *John remains thirsty*

(10b)   *John continues to be thirsty*

Finally the "iterative" aspect expresses the repetition of the same process or state, as in :

(11a)   *John est retombé amoureux*

(11b)   *John est tombé amoureux de nouveau*   (John fell in love again)

The "neuter" aspect is used when the process or state is designated as a whole without focusing on a specific phase of it. So far we have been dealing only with predicative elements with a neuter aspect. Let us consider now the four non-neuter aspects presented above. A non-neuter aspect is expressed by two means: either by lexicalization or by lexical items addition. Lexicalization is illustrated in examples (8a), (9a), (10a) and (11 a), while (8b), (9b), (10b) and (11b) are examples of lexical items addition. By lexicalization we mean that a predicative element of a given type expresses in itself a non-neuter aspect. With a *Vord* this is mainly, but not exclusively, rendered by means of different prefixes. In French, for instance, the following prefixes have an aspectual role :

- *en :* inchoative   *s'endormir = commencer à dormir* (start to sleep)

- *dé :* terminative   *se désintéresser = cesser de s'intéresser* (stop to be interested)

- *re :* iterative   *retomber = tomber à nouveau* (fall again)

These prefixes raise the issue of derivational morphology which will not be discussed here, however. A predicative element which is not a *Vord* (i.e. *Vsup-Npred, be-Adj, be-Prep X)* denotes a non-neuter aspect when used with a lexical aspectual variant of *Vsup* or *be.* For example, the predicative elements *gain-ascendancy* in (8a), *come-out of coma* in (9a), and *remain-thirsty* in (10a) are respectively non-neuter aspectual variants of *have-ascendancy, be-in coma* and *be-thirsty.* Note that a lexical aspectual variant of *Vsup* or *be* does not change the argument structure. The fact that a predicative element of type $Pred_i$ denotes a non neuter aspect x is noted $Pred_i$-aspx. The lexical items which are added to express a non-neuter aspect are mainly aspectual verbs such as *begin* in (8b) or *continue* in (10b), and adverbials such as *not anymore* in (9b) and *again* in (11b). Aspectual lexical items are noted Op-aspx and their addition to $Pred_i$ is noted Op-aspx + $Pred_i$.

The translation of Op-aspx + $Pred_i$ seems to be compositional (i.e. it is the translation of Op-aspx added to the translation of $Pred_i$) :

26

(12) *Jean a commencé à faire un croc-en-jambe à Marie --> John began to trip up Mary*

However a verb such as *begin* can be used with a predicative noun without its support verb:

(12a) *Jean a commencé un croc-en-jambe à Marie*

The translation of (12a) is the same as that of (12), so it could be obtained if the equivalence between (12) and (12a) were established by some 'coercion' operation (Pustejovsky 1989, 1991; Boguraev et alii 1990). Coercion phenomenon is out of the scope of this paper, so it will not be discussed here. Let us, on the other hand, examine the translation of a predicative element with a non-neuter aspect $Pred_i$-aspx, given that $Pred_i$ translates as $Pred_j$. The translation of the latter may induce two cases : either there exists a lexicalized non-neuter aspectual variant $Prep_j$-aspx, or there is none. The first case is represented in the following diagram:

neuter	$Pred_i$	-->	$Pred_j$
non-neuter	$Pred_i$-aspx	-->	$Pred_j$-aspx

neuter	*être riche*	--->	*be rich*
inchoative	*devenir riche*	--->	*grow rich*

neuter	*be acquainted (with)*	-->	*avoir connaissance (de)*
inchoative	*become acquainted (with)*	-->	*prendre connaissance (de)*

The second case is represented in the following diagram:

neuter	$Pred_i$	-->	$Pred_j$
non-neuter	$Pred_i$-aspx	-->	Op-aspx + $Pred_j$

neuter	*be thirsty*	-->	*avoir soif*
durative	*remain thirsty*	-->	*continuer à avoir soif*

neuter	*s'approvisionner*	-->	*stock up*
iterative	se *réapprovisionner*	-->	*stock up again*

The existence of these two cases of translation of $Pred_i$-aspx comes from the fact that the lexicalization of a non-neuter aspect for a given predicative element is a monolingual idiosyncratic phenomenon, as any lexicalization.

1.3. Other Semantic Values

Aspect is one kind of semantic information a sentence can convey. Other types of semantic information are diathesis and modality. As for aspect, they can be expressed either by special diathetic/modal operators or by lexicalized diathetic/modal predicative elements. As an illustration, one diathetic value is causativisation, which modifies the argument structure by adding a new argument with a causative denotation. As for aspect, causativisation may be expressed by two means, either by lexicalisation or by addition of an auxiliary factitive verb, noted Op-caus. There are *Vords* which have a causative denotation, as *amaigrir* in (13b):

(13a) *Jean maigrit*
(13b) Sa *maladie a amaigri Jean*

It is difficult to characterize all *Vords* which have a causative meaning, and this point will not be discussed here. For predicative elements which are not *Vords,* causativisation is lexicalized by means of elements noted Pred$_j$-caus. In the following examples, *give-hangover, make-sad* and *put-on diet* are respectively the causative variants of *have-hangover, be-sad,* and *be-on diet:*

(14a) *John has a hangover*
(14b) *This whisky gave John a hangover*

(15a) *John is sad*
(15b) *This letter made John sad*

(16a) *John is on a diet*
(16b) *The doctor put John on a diet*

The translation of a lexicalized causative operator is similar to that of a lexicalized aspectual variant. More precisely, given a predicative element Pred$_i$, which translates into the predicative element Pred$_j$, and which has a causative operator Pred$_i$-caus, the translation of Pred$_i$-caus may induce two cases, represented by the following diagrams:

1)   Pred$_i$ --> Pred$_j$
          Pred$_i$-caus   --> Pred$_j$-caus

          be thirsty   --> *avoir soif*
          make thirsty   --> *donner soif*

be on a diet	*--> être au régime*
put on a diet	*--> mettre au régime*

2) 　　　　　$Pred_i$　　　　　　　　　　　　　--> $Pred_j$
　　　　　　　$Pred_i$-caus　　　　　　　　　　　--> Op-caus + $Pred_j$

sink (intransitive)	*--> sombrer*
sink (transitive)	*-> faire sombrer*

be in the habit (of)	*--> avoir l'habitude (de)*
break somebody of the habit (of)	*--> faire perdre à quelqu'un l'habitude (de)*

Finally, let us consider modality. This semantic value, can also be expressed by two means, either by lexicalisation ($Pred_i$-mod) or by modal operators (Op-mod) added to $Pred_i$. A $Pred_i$-mod translates either as a $Pred_j$-mod:

This fruit is eatable ~> Ce fruit est mangeable

or as a Op-mod added to the translation of $Pred_i$:

Cette fenêtre n'est pas ouvrable --> This window cannot be opened

The translation of Op-mod added to $Pred_i$ seems compositional :

(17)　*John seems to be thirsty --> Jean semble avoir soif*

However, a verb such as *seem* can be used with an adjective or *Prep X* without its support verb *be:*

(17a)　*John seems thirsty*

The translation of (17a) is the same as that of (17) and it could be obtained if the equivalence between (17) and (17a) were established, in a similar way as the equivalence between (12) and (12a), where a *Npred is* used without its support verb.

1.4 Monolingual lexical information for predicative elements

To conclude this section on linguistic data, let us recapitulate the monolingual lexical information which is associated with a predicative element. First, the argument structure of any predicative element, whatever its type, is lexical information which indicates the number of

arguments, their semantic features and their syntactic realization. The linguistics data we have examined put forward the additional monolingual lexical information[4]:

- for a predicative noun *Npred,* its neuter support verb and the aspectual, diathetic and modal variants of this support verb (if any). As an illustration, the lexical information associated with the noun *ascendancy* is the following: it is a predicative noun which has two arguments, none of which is obligatory human, the second one is introduced by the preposition *over,* the neuter support verb is *have,* the inchoative variant *gain,* the terminative variant *loose,* the durative variant *keep* and the causativisation inchoative variant *give.* In the rest of this paper, the neuter support verb of an *Npred* and its variants will all be called "support verb";

- for a predicative adjective or a *Prep X* sequence, the lexical information is similar to that of a *Npred,* except that the neuter support verb is the same for all predicative elements of these two types, e.g. *be* in English. Moreover, for *Prep X,* additional information is needed for the preposition and the determiner, in some cases (Samvelian et alii 1992);

- for an ordinary verb *Vord,* the linguistic data we have examined involve the issue of derivational morphology, that we are not going to tackle here.

This lexical information structured the way it is allows us to use it straightforwardly in an MT system, as we are going to illustrate it with the Eurotra system, where the dictionary entry for e.g. *ascendancy* is as described above.
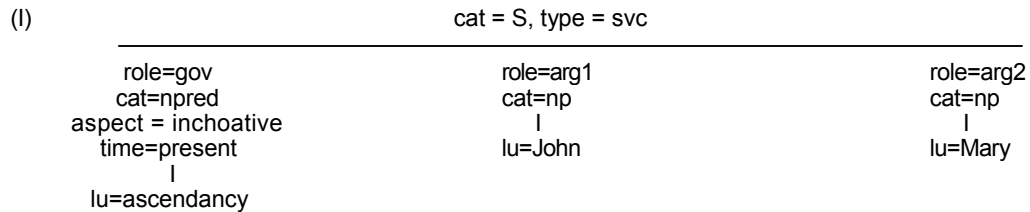
2 Automatic translation in a rule-based transfer system

Let us examine how to compute the translation of predicative elements in a transfer-based translation system and how it is actually handled in Eurotra. Only the design of the intermediary representations and the principles of the analysis, transfer and generation processes will be exposed. There is no room here to present in detail the actual implementation which is described in (Danlos et alii 1988, Danlos 1992, Daille and Danlos 1992, Samvelian 1990, Samvelian et alii 1992).

Eurotra uses a semantic-oriented representation which is a "lowered governor deep dependency grammar" (Allegranza et alii 1991, Durand et alii 1991). To handle the phenomena we are dealing with, the basic idea is that the governor of a sentence is its predicative element without

---

[4] Such lexical information is roughly recorded in (Melcuk 1984) dictionary where it is indexed under rubrics called "lexical functions".

its support (if any). The semantic information that comes from the support verb is featurized. Therefore, the support verb is not represented nor translated as lexical item. The realization of this basic idea does not go without problems (e.g. how to represent the fact that *Npred* in a support verb construction is part of a standard *NP* with determiners and possible modifiers?). These problems are discussed at length in (Danlos 1992). Here, we will content ourselves with a simplified version of the actual representation. The simplified representation of *John gains ascendancy over Mary* is the following:

(I)
	cat = S, type = svc	
role=gov cat=npred aspect = inchoative time=present | lu=ascendancy	role=arg1 cat=np | lu=John	role=arg2 cat=np | lu=Mary

In this representation, the predicative noun is the governor of the sentence which is of type "svc" = support verb construction). In analysis, (I) is obtained thanks to the equality between the verb and one of the support verbs which are recorded in the dictionary entry of the predicative noun. The value of the feature "aspect", i.e. inchoative, is obtained because *gain* is recorded as inchoative variant in the entry of *ascendancy.*

The translation of the predicative elements just require simple lexical transfer rules such as:

{lu = decision, cat =npred}   -->   {lu = décision, cat = npred}

{lu = ascendancy, cat =npred}   -->   {lu = ascendant, cat = npred}

{lu = thirsty, cat =adj}   -->   {lu = soif, cat = npred}[5]

Let us examine the translation of the sentence *John gains ascendancy over Mary* into French. The transfer of (I) leads to a tree which is identic except for the leaves, i.e. the lexical values. The French generation module accesses the entry of *ascendant.* This entry indicates that the predicative noun has an inchoative support verb which is *prendre* and that the second argument must be introduced by the preposition *sur*. So the French generation module builds up the sentence *Jean prend de l'ascendant sur Marie.* Let us underline again that no lexical transfer rule such as *gain (— ascendancy) --> prendre* is used.

_____

[5] The representation of an epithet adjective such as *thirsty* in *a thirsty man* is equivalent to the representation of *a man who is thirsty.* So we obtain the right translation *a thirsty man --> un homme qui a soif.*

Consider now the translation of *John remains thirsty* into French. Below the source and target representations:

```
        cat= S, type = svc                              cat= S, type = svc
    _____                    _____

    role=gov         role=arg1                    role=gov          role=arg1
    cat=adj          cat=np                        cat=npred         cat=np
    aspect=durative    |                           aspect=durative     |
       |               |                              |                 |
    thirsty          John                            soif             Jean
```

The French generation module accesses the entry of *soif.* This entry indicates that the predicative noun has no durative support verb but that its neuter support verb is *avoir.* So the French generation module introduces the durative aspectual verb *continuer (à)* which is added to the neuter support verb *avoir.* Consequently it builds up the sentence *Jean continue à avoir soif.*

3 Automatic acquisition of monolingual lexical information

The solution we propose is quite economic at the transfer level. However, this solution requires a lot of monolingual lexical information. Let us examine if it would be feasible to extract this lexical information from tagged corpora, taking as illustration the lexical information associated with an *Npred.*

First, one can lay down on statistical grounds that the support verbs of any *Npred* in a given language L belong to a closed class, noted L-vsup. For exemple, the most common support verbs in French are:

Fr-vsup = {avoir, faire, prendre, perdre, donner, recevoir, subir, conserver, garder, entamer, poursuivre}

The support verbs which do not belong to L-vsup are stylistic (exotic) variants such as:

Jean (a + nourrit + caresse) l'espoir de trouver un boulot
John (has + nourishes + entertains + toys with) the hope of getting a job

Second, one can assume that there exists an algorithm which produces for a given noun *N* the list V(N) of the x most frequent verbs *V* for which *N* is a (direct) object of *V* (such an algorithm can be inspired by the one used in (Smadja and McKeown 1990). For a non-predicative noun such as beer, the list V(N) should contain ordinary verbs which occur frequently with *N* as a (direct) object,

e.g. *drink, consume, enjoy* for *beer.* These verbs are eliminated when considering the intersection of V(N) with L-Vsup. This intersection is noted Vsup(N). For a non-predicative noun, Vsup(N) either should be empty (in which case *N* is known as non-predicative), or it should include verb(s) with which *N* form a collocation such as *have a beer* for *N =: beer, prendre une bière* for *N=: bière.* In the latter case, the wrong assumption that *N* is a predicative noun is made, but a bilingual rule such as *have a beer --> prendre une bière* can be automatically computed. For a predicative noun *N,* Vsup(N) should be made up of the support verbs of *N.* Each element of this list must be given a semantic value such as neuter, inchoative, etc. For some elements of L-vsup, this value is the same for any *Npred,* e.g. *perdre* has always a terminative value. For other elements of L-vsup, this value depends on *Npred,* e.g. *prendre* has a neuter value with *décision* and an inchoative value with *habitude .* However, it is possible to call upon rules such as the following (deduced from (Vivès 1983) data): if *prendre* and *perdre* both belong to Vsup(N), then *prendre* has an inchoative value.

To sum up, it should be possible to extract from tagged corpora the monolingual lexical information we need for our solution. This extraction is under study within the ET-10 project[6] (Gaussier et alii 1992).

Conclusion

There is little hope that a collocation like *make-decision* be translated correctly with a pure statistical approach when the two elements of the collocation occur in different clauses:

(18) *The decision that the French government is going to make about tobacco is disliked by the majority of the population*

This limit of the statistical approach can be considered as well known since the statistical models only capture local phenomena (Brown et alii 1991). Nevertheless, the translation of (18) is likely to be incorrect also in a rule-based system using contextual bilingual rules such as *make (— decision) --> prendre.* In conclusion, linguistics knowledge as that presented here is needed in both rationalist and empiricist approaches.

---

[6] ET-10 is a project which is co-funded by the European Economic Community and which is conducted by the Centre Scientifique d'IBM-France with TALANA, University of Essex and University of Lancaster as main participants.

Bibliography

Allegranza, V., Bennett, P., Durand, J., Van Eynde, F., Humphreys L., Schmidt, P., Steiner, E.,   1991, "Linguistics for Machine Translation: The Eurotra Linguistic specifications", in *Studies in Machine Translation and natural language processing,* Vol 1, Luxembourg: Commission of the European communities.

Boguraev, B., Briscoe, T., Copestake, A., "Enjoy the paper: Lexical Semantics via Lexicology", in *Proceedings of COLING '90,* Helsinki, Finland.

Brown, P., Cocke, J., Della Pietra, S., Della Pietra, V., Jelinek, F., Mercer, R., Roossin, P., 1988, "A statistical approach to language translation", in *Proceedings of COLING '88,* Budapest Hungary.

Brown, P., Della Pietra, S., Della Pietra, F., Mercer.R., 1991, "Word-sense disambiguation using statistical methods", in *Proceedings of ACL '91,* Berkeley, USA.

Cattel, R., 1984, Composite Predicates in English, *Syntax and Semantics,* vol. 17, Academic Press, New York.

Daille, B., Danlos, L., "Les constructions à verbe support : description linguistique et implementation dans Eurotra", Rapport technique TALANA, n° 4, Paris.

Danlos, L., 1980, *Représentation d'informations linguistiques : les constructions N être Prép X,* Thèse de 3ème cycle, Université de Paris 7.

Danlos, L., 1981, "La morphosyntaxe des expressions figées", *Langages,* Larousse, Paris.

Danlos, L., 1986, "Une illustration d'étude formelle des noms : *charg(-e, -er -ement)", Langue Française,* 69, Larousse, Paris.

Danlos, L., 1988, "Les expressions figées construites avec le verbe support *être Prép* ", *Langages,* 90, Larousse, Paris.

Danlos, L., 1988, "Les problèmes posés par les verbes support en traduction automatique", in *Actes du Colloque Informatique et Langue Naturelle,* Université de Nantes, Nantes.

Danlos, L., with   A. Bech, F. Caroli, B. Daille, N. Mesli, F. Namer, S. Nohr, 1989, "Support verbs and Predicative Nouns in a machine translation system", in *Eurotra Reference Manual 6.0, Technical report of Eurotra,* Luxembourg.

Danlos, L., 1992, "Support Verb Constructions: linguistic properties, representation, translation", *Journal of French Language Studies,* Vol 2, n°1, Cambridge University Press, Cambridge.

Durand, J., Allegranza, V., Bennett, P., Van Eynde, F., Humphreys L., Schmidt, P., Steiner, E., (1991). The Eurotra Linguistic specifications: An overview. *Machine Translation,* vol 6, Netherlands: Kluwer Academic Publishers.

Gaussier, E., Langé, J.-M., Meunier, F., 1992, Towards Bilingual terminology", in *Proceedings of ALLC/ACH Conference,* Oxford, England.

Giry-Schneider, J., 1978, Les *nominalisations en français : l'opérateur "faire" dans le lexique,* Droz, Genève.

Giry-Schneider, J., 1987, *Les prédicats nominaux en français : les phrases simples à verbe support,* Droz, Genève.

Gross, M., 1981, "Les bases empiriques de la notion de prédicat sémantique", *Langages 63,*   Larousse, Paris.

Gross, G., 1989, *Etudes syntaxiques de constructions converses,* Droz, Genève.

Melcuk, I., 1984, *Le Dictionnaire explicatif et combinatoire du français contemporain,* Presses de l'Université de Montréal, Montréal.

Meunier, A., 1981, *Nominalisation d'adjectifs par verbes supports,* Thèse de 3ème cycle, Université de Paris 7, Paris.

Pustejovsky, J., 1989, "Issues in computational lexical semantics", in *Proceedings of ACL '89,* Manchester, England.

Pustejovsky, J., 1991, "The generative lexicon", in *Computational Linguistics,* Vol 17, n°4, MIT Press.

Samvelian, P., 1990, *Les constructions être Prép X : formalisation et traitement dans la cadre d'Eurotra ,* DEA, Université de Paris 7, Paris.

Samvelian, P., Gavrilidou, M., Ruimy, N., Svendsen, U., 1992, *"Be Prép X* constructions in a machine translation system", *Technical report of Eurotra,* Luxembourg.

Smadja, F., McKeown, K., 1990, "Automatically extracting and representing collocations for language generation", in *Proceedings of ACL'90,* Pittsburgh, USA.

Vivès, R., 1983, *Avoir, prendre, faire. Constructions à verbes supports et extensions aspectuelles.,* Thèse de 3ème cycle, Université de Paris 7, Paris.