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AUXILIARIES AND CLITICS IN FRENCH
UCG GRAMMAR

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ABSTRACT
French auxilliaries and clitics have been analysed in the flame of U.C.G. (Unification Categorial Grammar). Concatenation of a functor sign and an adjacent argument sign is the basic operation of the model; unification allows (a) to verify if constraints on concatenation are respected; (b) to produce a flow of information between the functor sign and the argument sign.

The rules of the grammar and the design structure of the sign allows to express: (a) the concatenation between French auxilliaries (etre and avoir) and the participle verb form within a single pattern, (b) transitions between clitics in a systematic way. Two complex questions of French syntax are thus covered in a fairly simple way.

The UCG Model
Unification C(ategorial) G(rammar) is a new grammatical model proposed by an Edinburgh team headed by Ewan Klein in [CALDER 86] and [ZEEVAT 86]. UCG is a feature grammar incorporating some basic insights from GPSG [GAZDAR 85] and HPSG [POLLARD 84]. Functional application applies in UCG as in categorial grammars; it allows for concatenation of a functor with an adjacent argument. Unification is a basic operation which allows (a) to verify if constraints on concatenation are respected; (b) to produce a flow of information between functor and argument. This information together with some defined aspects of the information carried by the functor, will be finally inscribed in the resulting concatenated sign.

The Sign
A UCG sign has the following format:

(1)

| sign --> category:semantics:order:phonology |
| category --> head:features:catlist |
| features --> [feat,clo,agree,class] |
| catlist --> nil |
| catlist --> catlist/active |
| active --> sign |
| semantics --> index |
| semantics --> index:predicate:arglist |
| arglist --> agr1, ..., argn |

In graph notation, a UCG sign can be represented (in a slightly simplified form, relevant to this paper) as in figure 1.

In this figure the leaves of vertical branches columns (i) through (viii) - denote the values of the corresponding labels in its upper portion.

We have:
(i) to (vi) Simple categories: sent=nil, noun=nil.
(ii) Features on (i) (see below)
(iii) values for the CL(itics) label are: prod (dialogue pronouns, for me, te, nous, vous); protob (third person object pronouns: le, la, les); prota (third person dative pronouns: lui, leur); se, en and y, (for se, en and y pronouns respectively); n is a barrier symbol (see below).
(iv and v) values for morphological aspects of the sign:
(iv) categorizes signs in lex(ical) and pron(ominal) ones;
(v) in masc(ulin) and fem(inin) in sing(ular) and pl(ural), and introduces values for the 3 persons.
(vi) the subcatlist: the label C will denote the typical variable for it.
(vii) the index sort system (which is not exhibited here)
(viii) post and pre are the values for order; they are essential for handling word order and for the application of the grammar rules.

In the unification process and in the generation of the subsequent flow of information, the labels Class, Ge, Nb and Pe denote variables for the corresponding values; Clo the variable for clitic placement value and O, the variable for order values.

The two following are the French UCG signs for aine and Marie:

order --> pre | post
phonology --> <lexical_item>

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(2) (a) \textit{aime}

\begin{verbatim}
  sent`(fin,v,(_:sg:p3),_)
  :nil[np`(nom,n,(_:sg:p3),_)::nil:X:pre:_,
    /np`[acc,m,_,_]:nil:Y:post:_,
    :and(e,at(e,now),aimer(e,X,Y))
  :O
  :aime

(b) Marie

  Head'[Feat,Clo,Ag,Class]
  :C/(Head'[Feat,_,Ag,Class]
  :C/(np'[or(nom,acc),Clo,(fem:sg:p3),lex]
    :nil:marie:Ord:_,)
  :Sem
  :Ord
  :_:)
  :Sem
  :O
  :marie
\end{verbatim}

Categories

Categories are defined by

3) (a) A simple category is a category.
(b) If H:C is a category and Si is a sign, H:(C/Si)

is a category.

Rules

[ZEEVAT 86] describes 2 grammar rules based on

functional application.

4) FA (Forward Application)

Functor:

\begin{verbatim}
  HF
  :CF/(HA:CA:SA:pre:_)
  :SF
  :OF
  :W1
\end{verbatim}

Argument:

HA:CA:SA:pre:W1

-> HF:CF:SF:OF:[W1,W2]

5) BA (Backward Application)

Argument:

HA:CA:SA:post:W1

Functor:

\begin{verbatim}
  HF
  :CF/(HA:CA:SA:post:_)
  :SF
  :OF
  :W2
\end{verbatim}

Argument:

HA:CA/(np'[Feat,_,Ag,`lex]:nil:X:o:)::SA:pre:W2

-> HF

\begin{verbatim}
  :CF/(np'[Feat,_,Ag,`lex]:nil:X:o:_,)
  :SF
  :OF
  :W1
\end{verbatim}

We added two rules to these, inspired by

functional composition as described in [STEEDMAN 86].

6) FC (Forward Composition)

Functor:

\begin{verbatim}
  HF
  :CF/(HA:CA:SA:pre:_)
  :SF
  :OF
  :W1
\end{verbatim}

Argument:

HA:CA/(np'[Feat,_,Ag,`lex]:nil:X:o:)::SA:pre:W2

-> HF

\begin{verbatim}
  :CF/(np'[Feat,_,Ag,`lex]:nil:X:o:_,)
  :SF
  :OF
  :W1
\end{verbatim}

FC is basically designed to deal with np-gaps.

7) BC (Backward Composition)

Argument:

HA:CA/(np'Feats nil:X:O:o:)::SA:post:W1

Functor:

\begin{verbatim}
  HF
  :CF/(HA:CA:SA:post:_)
  :SF
  :SO
  :W2
\end{verbatim}

Argument:

HA:CA/(np'Feats nil:X:O:o:)::SA:post:W1

Functor:

\begin{verbatim}
  HF
  :CF/(HA:CA:SA:post:_)
  :SF
  :SO
  :W2
\end{verbatim}

-> HF

\begin{verbatim}
  :CF/(np'Feats nil:X:O:o:_,)
  :SF
  :OF
  :W1
\end{verbatim}

BC is designed to deal with free-order of np-

arguments of verbs

Forward application must be interpreted as

follows:

\[1\] where PROLOG conventions are respected: lower

case = constant, upper case = variable, _ = anonymous

variable

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If a sign of string W1 and category HF:CF/(HA:CA) unifies with a sign of string W2 and category HA:CA, W1 concatenates with W2; the resulting sign, with string [W1,W2], is of category HF:CF, where HF:CF is the category inherited from the functor as resulting from unification with its argument, and stripping HA:CA.

Mutatis mutandis, analogous interpretations must be given to (5) through (7).

By definition (3) HA:CA in HF:CF/(HA:CA) of (4) must be a sign; it is the active part of the functor. The final concatenated sign is obtained by stripping the active part of the functor as instantiated by the argument.

Example

For example: (8) is the instantiation by BA of (2b) as the functor with respect to (2a) as the argument of the rule; (9) is the resulting sign, obtained from (8) by stripping; (10) represents the sign of the whole sentence Pierre aime Marie:

(8) Marie

sent’[fin,m,(\_:sg:p3),Class]\nnil/np’[nom,n,(Ge1:sg:p3),Class1]:nil:X:pre:P1
\n\n(9) aime Marie

sent’[fin,m,(\_:sg:p3),Class]\nnil/np’[nom,n,(Ge1:sg:p3),Class1]:nil:X:pre:P1
\n\n(10) Pierre aime Marie

sent’[fin,n,(\_:sg:p3),Class]\nil
\n\nSemantics

The semantics of UCG incorporates the basic insights of Kamp’s DRT [KAMP 81] but the introduction of indexes greatly increases the expressive power of semantic representations (cf. [ZEEVAT 86]).

To resume:

The whole model is based on:

* one unique operation: concatenation between adjacent constituents.
* one unique process to control the flow of information and to verify conditions: unification.

* similar ways to combine a functor and its argument to give a resulting sign.

The French sentence

simple verbs

They accept left-placed arguments (as clitics) and right-placed ones (as lexical ones).

composed verbal forms

No argument can be inserted between the auxiliary and the participle form.

Whereas in English only one auxiliary is used to construct perfect tenses, French uses avoir and être depending on the main verb. Furthermore, être is also used for passive constructions.

The most important problem, however, is due to the agreement of the past participle with the subject of the main verb when used with être, but with the object -only if it precedes the auxiliary- when used with avoir.

However, we succeeded to maintain a single lexical entry for a verb, allowing for the different order of arguments. This is made possible by the introduction of forward and backward composition rules.

**AUXILIARIES**

The following are the main features allowing a correct treatment of auxiliaries in a French UCG grammar:

Features as presented in Figure 1 column (ii): PSPA for past participles of verbs using avoir as auxiliary, PSPE for verbs used with être, PAS for passive participle. They allow for the distinction between finite and non-finite forms and between participles used with avoir or être.

Values for the CL label: v value denotes the fact that the verb is "virgin" i.e. has not consumed any of its arguments.

Values for GE, NB, PERS allow for correct agreement of the past participle and between auxiliary and subject.

A unique format for perfect tenses with avoir and être and for passive constructs with être was designed as follows:

(12) auxiliary general design

```
\n```

where STRING and FEAT can take values avoir and pspa or être and pspe or pas; the agreement of the auxiliary unifying with the agreement of the participle will insert the correct agreement on the nominative argument in the participle and thus will control the agreement of the subject with the auxiliary-participle unit.

One of the main achievements of our French UCG grammar is to have a single lexical entry for a verb, notwithstanding differences in semantics according to
tense, free word order, and constrained word order due to clitics.

Standard lexical entries present word order as for non-clitic arguments, and semantics as for the infinitive.

A morphological component allows for a dynamic transformation of these entries according to tense gender and person.

Thus, typical entries look like:

(13) regarder

\[
\text{regarder}(e, X, Y) :O
\]

When analysing (morphologically) the passive participle (13) is transformed (by a special passive lexical rule) into:

(14) regardée

\[
\text{regardée}(e, X, Y) :O
\]

go to be combined with an auxiliary as

(15) être

\[
\text{être}(e, X, Y) :O
\]

yielding

(16) est regardée

\[
\text{est regardée}(e, X, Y) :O
\]

This can then correctly be combined with the subject Marie (2b) respecting the agreement auxiliary-subject and subject-participle (because it is used with être)

CLITICS

Beside the fact that clitics in French are always placed before the verb or verb-auxiliary unit (as it was said before) there are also restrictions concerning placement between them.

It is thus necessary to specify (17 a) and to exclude (17 b), among others.

(17) (a) Marie lui_ [dat] a donné un livre_[acc]
(b) Marie a lui_[dat] donné un livre_[acc]

The main problem with French clitics is that arguments combine in a different order with the verb according to (a) whether they are clitic or not and (b) whether they are first/second person or third person.

(18) (a) Marie donne un livre_[acc] à Pierre_[acc]
(b) Marie lui_[dat] donne un livre_[acc]
(c) Marie le_[acc] lui_[dat] donne
(d) Marie me_[dat] le_[acc] donne

The core of conditions on clitic ordering in French can be found in (19). These transitions are valid for argumental clitics and non-argumental ones (for example, VP modifiers, as y in Il y a apporté un livre), but the present paper is only intended to cover the argumental ones.

(19)

\[
\begin{array}{cccccccc}
\text{pro[acc]} & \varnothing & * & * & * & * & * & * \\
\text{pro[dat]} & * & & * & * & * & * & \\
\text{pro[verb]} & * & * & * & * & * & * & \\
\text{y} & * & & & & & * & * \\
\text{m[acc]} & * & * & * & * & * & * & * \\
\text{m[dat]} & * & & & & & * & * \\
\text{w[acc]} & * & * & * & * & * & * & * \\
\text{w[dat]} & * & * & * & * & * & * & * \\
\end{array}
\]

The complex information of the matrix are included in a uniform way in the clitics lexical entries.

The basic template for clitic is:

\[
\text{Head}[\text{Feat}, \text{Cl2}, A, \text{Class}] :C / (\text{Head}'[\text{Feat}, \text{Cl1}, A, \text{Class}]) :C / \text{nil}/[\_, 
\text{pro}[X]] :O
\]

where the relation between Cl2 and Cl1 constains the matrix information relevant for each clitic.

IMPLEMENTATION

The UCG French grammar has been implemented at the Laboratoires de Marcoussis (France) on a VAX 780 in C-PROLOG using PIMPLE, a PROLOG implementation of a PATR-II like tool for development of unification grammars, implemented by the Centre for Cognitive Science of Edinburgh University.

Some more examples with auxiliaries and clitics

Entries for the sentence Marie la lui a donné :
(20) la

Head^[Feat, protob, A, Class]
:C / (Head^[Feat, or(prom, y, m, v), A, Class]
:C/np^[acc, _, (fem: sg: p3), pro]: nil: pro(X): _
:S
:pre
:)
:S
:O
:la

(21) lui

Head^[Feat, prota, A, Class]
:C / (Head^[Feat, or(en, m, v), A, Class]
:C/np^[dat, _, (fem: sg: p3), pro]: nil: pro(X): _
:S
:pre
:)
:S
:O
:lui

(22) a

sent^[fin, v, (_: sg: p3), Class]
:C/sent^[pspa, v, (_: sg: p3), Class]: C: Sem: pre:
:Sem
:O
:a
donner as modified by morphological rules into a past participle:

(23) donnée

sent^[pspa, v, Ag, _]
:nil/np^[nom, n, Ag, _]: nil: X: pre:
:/np^[acc, n, (fem: sg: _), pro]: nil: Y: pre:
:/np^[dat, m, _]: nil: Z: post
:donner(e, X, Z, Y)
:O
:donnée

donnée as combined in the following way:
a with donnée by FA yielding:

sent^[fin, v, (_: sg: p3), _]
:nil/np^[nom, n, (_: sg: p3), _]: nil: X: pre:
:/np^[acc, n, (fem: sg: _), pro]: nil: Y: pre:
:/np^[dat, m, _]: nil: Z: post
:donner(e, X, Z, Y)
:O
:[a, donnée]
lui with [a, donnée] by FA yielding:

sent^[fin, prota, (_: sg: p3), _]
:nil/np^[nom, n, (_: sg: p3), _]: nil: X: pre:
:/np^[acc, n, (fem: sg: _), pro]: nil: Y: pre:
:donner(e, X, pro(Z), Y)
:O
:[lui, [a, donnée]]

la with [lui, [a, donnée]] by FA yielding:

sent^[fin, protob, (_: sg: p3), _]
:nil/np^[nom, n, (_: sg: p3), _]: nil: X: pre:
:donner(e, X, pro(Z), pro(Y))
:O
:[la, [lui, [a, donnée]]]

marie with [la, [lui, [a, donnée]]] by FA yielding:

sent^[fin, n, (_: sg: p3), _]
:nil
:donner(e, marie, pro(Z), pro(Y))
:O
:[marie, [la, [lui, [a, donnée]]]]

Entries for the sentence Marie lui est donnée:

(24) est

sent^[fin, v, Ag, Class]
:C/sent^[or(pas, pspe), v, Ag, Class]: C: Sem: pre:
:Sem
:O
:est
donnée by FA yielding:

sent^[fin, v, (fem: sg: Pe), _]
:nil/np^[nom, n, (fem: sg: Pe), _]: nil: X: pre:
:/np^[acc, n, (fem: sg: _), pro]: nil: Y: pre:
:/np^[dat, m, _]: nil: Z: post
:donner(e, unknown, Z, Y)
:O
:donnée

est with donnée by FA yielding:

sent^[fin, v, (fem: sg: Pe), _]
:nil/np^[nom, n, (fem: sg: Pe), _]: nil: X: pre:
:/np^[acc, n, (fem: sg: _), pro]: nil: Y: pre:
:/np^[dat, m, _]: nil: Z: post
:donner(e, unknown, Z, Y)
:O
:[est, donnée]
lui with [est, donnée] by FA yielding:

sent^[fin, v, (fem: sg: Pe), _]
:nil/np^[nom, n, (fem: sg: Pe), _]: nil: X: pre:
:/np^[acc, n, (fem: sg: _), pro]: nil: Y: pre:
:/np^[dat, m, _]: nil: Z: post
:donner(e, unknown, pro(Z), Y)
:O
:[lui, [est, donnée]]
Marie with (lui, est, donnée) by FA yielding:

```
(sent'[fin,v,(fem:sg:Pe),_] :nil 
:donner(e,unknown,pro(Z),marie) :O 
:[Marie,(lui, est, donnée)])
```

REFERENCES

[CALDER 86]

[GAZDAR 85]

[KAMP 81]

[POLLARD 84]

[STEEDMAN 86]

[ZEEVAT 86]