The representation of syntactically unexpressed complements to nouns

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Abstract

We address the representation of nouns having complex argument structures like deverbal nominalisations. In particular we address the semantic representation of syntactically unexpressed arguments. We put forward a treatment of this kind of optional complements in a framework that combines HPSG syntax and the semantic approach in GL (Pustejovsky, 1995).

1 Introduction

In this paper we address the representation of nouns having complex argument structures like deverbal nominalisations (and other nouns with complements). These classes of nominals very often appear in the surface string without their complements, even if they are semantically implied. Such semantic implications are often shown in discourse, so that anaphoric references cannot be accounted for without taking them into account. We put forward a treatment of unexpressed complements to nouns in a framework that combines HPSG syntax and the semantic approach in GL (Pustejovsky, 1995).

In the next section we present some data concerning the semantic implications of syntactically unexpressed complements. Our data are basically from Catalan, but the discussion is clearly applicable to other languages including English. In the third section we discuss the deficiencies of the standard treatments of optionality of complements. Finally, in section four we put forward our proposal. We concentrate on the representation of deverbal nominalisations, but we discuss some other kinds of optional complements to nouns.

2 Data

Most predicative nouns (i.e., those having complements) may or may not have their comple-
ments present in the sentence.[1] In other words most complements to nouns are optional (in an appropriate context):[2]

(1) a. Avui he   vist el pare del
       Today have(1-s) seen the father of-the
       Joan
       Joan

    b. Hi   ha dos pares que no han
       There are two fathers that not have(3-s)
       vingut a buscar el nen
       come   to fetch the child

(2) a. Compraré   dos fulls   de catrolina
       Will-buy(1-s) two sheets of card

    b. Escriu-ho en un full
       Write-it on a sheet

(3) a. Aquesta tarda   un grup de nens
       This   afternoon a group of children
       jugava a la plaça
       played on the square

    b. El   grup l'   ha acceptat molt
       The group him/her has accepted very
       bé
       well

Of course optionality of complements is not limited to nominal complements: it is pervasive among verbal complements as well. Even within the context of verbal complements the discussions in the literature show that the distinctions between classes of complements are far from obvious. At the simplest level a twofold distinction

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[1] Here and throughout this paper we use the term "predicative noun" to refer to nouns that can have complements, thus including deverbal and adjectival nominalisations and relational nouns.

[2] In the following a-examples the complements of nouns that are omitted in the b-examples are written in bold face. Note that the contexts usually have to be different.

may be proposed between (obligatory) complements and (optional) adjuncts. This however does not comply with the facts since it groups together very different classes of optionality: grammatically induced elision (4), optionality with semantic implications (5), as a pure adjunct (6)...[3]

(4) a. Avui s'   ha comentat la novel·la
       Today ReflPr has commented the novel

   b. Avui els estudiants han
      Today the students   have(3-p)
      comentat la novel·la
      commented the novel

(5) a. Menja sempre en   tornar de l'
       Eats always when come from the
       escola
       school

   b. Menja sempre pa   amb xocolata
      Eats always bread and chocolate
      en   tornar de l' escola
      when come from the school

(6) a. Avui he   estat pintant al
       Today have(1-s) been painting at-the
       parc
       park

   b. Avui he   estat pintant
      Today have(1-s) been painting

These very simple examples show that the presence or absence of complements to predicative heads is not uniform from a semantic point of view. There are complements which are semantically external to the predication, whereas there are others that are internal (that is to say, that contribute some entity to the relation denoted by the predication). And complements may or may not be present according to their semantic relation to the head. Most external complements (i.e., adjuncts) are always optional: they may be present or absent irrespective of their particular relation.[4] But there are many internal complements that can be optional and some cannot be present except under very specific circumstances; these are the complements described as *default-* and *shadow-arguments* respectively in Pustejovsky (1995:63f):

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[3]Some authors have proposed a graded classification consisting of 5 to 7 classes (Somers, 1987).

[4]However there are a few cases where one might want to say that there are obligatory adjuncts, as for example in: *this suit washes easily*.

(7) a. **D-Arg**: John built the house **out of** bricks

   b. **S-Arg**: Mary buttered her toast **with an expensive butter**

When dealing with a purely syntactic grammar (or lexical representation) all these aspects boil down to determine the degree of optionality of the complement and to deal with the variation in syntactic behaviour accordingly. That is to say in many implementations of syntax some optionalities are dealt with by general rules or principles (this is clearly the case of the optionality of the logical subject, which is either accounted for by a passivisation/impersonalisation rule of the grammar or by a lexical operation) and some are accounted for by listing them as different entries (or just as subentries of the same entry). But except for the cases where a grammatical relation clearly exists that applies to most lexical items of a particular class (as passivisation to transitives), the optionality of complements is dealt with by listing all the options in the dictionary. Furthermore such a treatment does not include some of the complements that are allowed only under certain very specific circumstances (e.g. **D-Arg**, **S-Arg**) since these can only be spelt out in semantic terms.

Not surprisingly the application of these notions of obligatory and optional complements (developed for VPs and Ss) to NPs has not been successful: too many arguments in the NP are optional and there is too little grammatical control (such as the one we find in passivisation) for general, syntactically based treatments to be successful. Note that even the simple distinction between objective and subjective complements cannot be made operative on syntactic terms in Catalan and other languages (i.e., without taking into account their semantics):

(8) a. l' estudi de les plantes
       the study of the plants

   b. la solució dels   estudiants
      the solution of-the students

   c. l' avaluació dels inspectors
      the evaluation of-the inspectors

But in addition there are strong reasons to consider that a semantic approach has to be taken to predicate-complement representation

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if we consider discourse factors, such as coherence, anaphora and the recovering of implications. Consider the following examples:

(9) a. La decoració   del   pont
        The decoration(f-s) of-the bridge(m-s)
        ens ha portat molt de temps, però ha
        us has taken much of time, but has
        quedat molt ben acabada!
        resulted very vell finished(f-s)!

    b. La traducció d' aquest pamflet m'
       The translation of this   pamphlet me
       ha costat molt, però al   final
       has costed a-lot, but at-the end
       crec   que m' ha quedat molt
       beleive(1-s) that me has resulted very
       natural
       natural

    c. Traduir   aquest pamflet m' ha
       To-translate this   pamphlet me has
       costat molt, pero al   final crec
       costed a-lot, but at-the end beleive(1-s)
       que m' ha quedat molt natural
       that me has resulted very natural

    d. Ha vingut una mare   aquest matí.
       Has come a   mother this   morning.
       Venia   a dir que el seu fill no
       Came(3-s) to tell that the her son not
       podrà   venir a l'   excursió
       will-can come to the excursion

    e. Hem   amanit l' enciam i   l'
       Have(1-p) dressed the salad and it(ac)
       hem   hagut de llençar   perque
       have(1-p) hat   to throw-away because
       l' oli era ranci
       the oil was rancid

These examples show that complements not explicitly present in the NP or VP can be referred to or implied in discourse. Of course the subject of *acabada* (9a) and *natural* (9b and 9c) is only recoverable as the result of the decorating and translating act respectively; and the use of definite specifiers *el seu* and *l* in (9d) and (9e) is allowed by the "hidden" complement of *mare* and *amanir*.

3 Standard treatment in argument structure

The standard treatment of syntactically oriented representations introduces some level of abstract description of argument structure in syntax, so that general grammatical relations

can be accounted for in a straightforward way. Thus, content relations can be stated between arguments and their heads that differ from the surface syntactic ones. In HPSG, for example, control relations are expressed as coindexation between syntactic and argument values, in such a way that a single valence element realises two argument slots; and passive is (lexically) dealt with as a change in the correlation between valence elements and argument ones.[5]

But this level where argument structure is usually represented is a direct projection (although neither simple, nor one-to-one) of the surface structure. That is to say there are difficulties in incorporating new argument slots when no correponding syntactic slot exists. And this is so simply because the argument values are not thought as full semantic representations but simply as the deep representation of syntactic structure.[6]

Being syntactically oriented, the standard treatments of argument structure can only represent the types of complements that correpond to the simple twofold distinction mentioned in the previous section: strongly restricted obligatory complements and optional adjuncts.[7] Nonetheless, there are at least three aspects that are not considered in a satisfactory way: complements to verbs and to nouns which are not linked with a strong syntactic and semantic relation, but cannot be treated as ordinary adjuncts, i.e., intersectively (as for instance the kind of complements mentioned in footnote 4); complements to nouns generally, because they usually are optional (as in (1) to (3) above); and some complements to verbs which are manifestly optional (as in (5)). This is so because in the standard typing of arguments

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[5]Recall that the syntactic valence is expressed in HPSG as a list of descriptions of the complements which include their semantics, and that the argument structure is obtained by coindexing the semantic part of that description with the appropriate argument slot.

[6]In HPSG there is some ambiguity here, since the argument structure is embedded within the content part of the sign, where a lot of terminolgy is used that comes from situation semantics.

[7]In HPSG for example the representation for the former is strictly based on the coindexation between syntactic and argument values, whereas the treatment for the latter assumes an event structure for predication and intersects it with the optional adjunts (see Badia & Colominas (1996)).

there is no way to introduce arguments (or other kind of slots) that are not induced syntactically (or grammatically) in a restrictive way. A full theory of lexical semantics is needed to do so in a consistent way. For example, in Badia (1997) a particular case is considered and solved in an ad hoc way: the nominal *translation* (as in 9b above) is said to have an extra argument (to those inherited from the verb) so that its result reading can have its denotation properly derived. This of course is only adequate for a small class of the complements we have here in mind (see examples in (8) and (9) above) and does not derive from a general theory of argument structure.

Such optional complements have only been treated in standard treatments by creating distinct lexical entries, where the omitted complement is either just not present in the argument structure representation or represented by an abstract existential quantification (without a correspondence to any syntactically realised element). However this treatment neither reflects the relation between the different lexical entries that exist for a single word, nor is adequate in avoiding lexical redundancy. An alternative option that could be considered is to treat those complements as adjuncts. However the treatment of adjuncts has not been fully developed yet, so that most of the proposals at hand are only adequate for intersective adjuncts.[8]

Furthermore, complements to nouns are particularly difficult. From a semantic (and argument structure) point of view many of them are like complements to verbs, in that they contribute entities to the relation denoted by the noun; thus an adequate treatment might introduce a particular number of arguments for every relation class denoted by nouns (just as it is done for verbs) (Badia & Colominas, 1996). But from the syntactic point of view the difficulty arises because they cannot be simply introduced in the valence lists (as verbal complements are). And a simple treatment as adjuncts is not very satisfactory either since it would increase the complexity of the semantic calculations.

4 Proposed treatment

In the following we attempt to account for some optional complements of predicative nouns in HPSG, by enlarging the semantic information and representing these complements in an information level distinct from the valence lists. With regards to our semantic representation proposal, we maintain the referential information level in HPSG, expressed by means of the INDEX attribute. However we follow Pustejovsky (1995) in enriching the argument structure information level (expressed in HPSG as the RESTRICTION attribute and adapted here as ARGUMENT-STRUCTURE (ARGSTR)), so that D- and S-Args can be represented (in addition to the strictly obligatory ones). Furthermore we also introduce the EVENT-STRUCTURE (EVSTR) and QUALIA levels of information estipulated in Pustejovsky (1995). The latter describes the lexical semantics of the entity and its related arguments, whereas the former displays the event properties of the expressed eventuality. As will be seen below, the argument structure level acts as interface between the mechanisms that allow for the syntactic realisation of the complements and the rich lexical semantics –constituted by the EVSTR and QUALIA levels.[9]

Let us now consider the syntactic treatment of D- and S-Args. Due to their optionality, the HPSG standard treatment of obligatory complements by means of valence lists is not adequate for them. Nonetheless a recent proposal by Sanfilippo (1998) gives a good insight into how they can be treated. For independent reasons he proposes that some complements are treated as real adjuncts from a syntactic point of view, even if they are thematically bound to the relation denoted by the head. We adopt this mechanism and represent D- and S-Args as thematically bound adjuncts, introduced as set members at the nonlocal (NONLOC) information level. Thus the basic structure of the sign is as follows:[10]

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[8]Non intersective adjuncts cannot be easily treated, particularly those that contribute a new entity involved in the relation denoted by the predicate (for some of them quite complex proposals have been developed within HPSG: e.g., Kaspers, 1994).

[9]In fact our implementation follows the lines developed by Copestake (1992), Johnston (1996), among others. Particularly we follow the formalisation of Pustejovsky's semantics in feature structures developed in Johnston (1996). In his treatment the selection of the appropriate reading in aspectually-based verbal polysemies is expressed by means of a boolean value in the head attribute of each of the relevant qualia (see figures below).

[10]For reasons of space we do not include the LOC at-

$$\begin{bmatrix} \text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \text{head} \\ \text{VALENCE} & \text{lists-of-obl-compls} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \text{index} \\ \text{EVSTR} & \text{event-structure} \\ \text{ARGSTR} & \text{argument-structure} \\ \text{QUALIA} & \begin{bmatrix} \text{FORMAL} & \text{relation} \\ \text{AGENTIVE} & \text{relation} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{NONLOC|INHER|SLASH} & \text{set-of-opt-compls} \end{bmatrix}$$

Consider firstly an ordinary process-result nominal such as *construcció* ('building'). It is a nominalization from the verb *construir* ('build'), which subcategorises for two obligatory complements: the agent and the result of the building process.

As indicated in Pustejovsky (1995) this verb has also a third argument expressing the material, a D-Arg, which is syntactically optional but participates in the logical expression of the event (see example (7a) above). In the representation for that verb (figure 1), the first two complements are expressed in the valence lists, whereas the latter is treated according to Sanfilippo's proposal for thematically bound adjuncts; that is, as a member at the nonlocal information level. In figure (2) we show the process nominalisation of *construir* where not only the D-Arg but also ARG1 and ARG2 are not declared in the valence lists but included in the nonlocal set. Recall that we treat them like D-Args.

For our implementation we use LKB (Copestake, 1993). We first derive the process reading of the nominal from the verbal lexical entry: the nominal representation for the process reading (in figure 2) is obtained by (non-locally) inheriting from the already existing lexical entry of the verb (in figure 1).[11] And secondly the lexical entry for the result sense of *construcció* is created by means of a lexical rule that replaces the EVSTR head value and removes the ARG2 attribute, the value of which is now declared as the *index* value. ARG2 has to be removed since, as it expresses the entity resulting from

$$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & verb \\ \text{VALENCE} & \begin{bmatrix} \text{SUBJ} & \langle \text{NP}_{\boxed{1}} \rangle \\ \text{COMPS} & \langle \text{NP}_{\boxed{2}} \rangle \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{e1} \\ \text{EVSTR} & \begin{bmatrix} \text{EVENT1} & \boxed{e1}\ process \\ \text{EVENT2} & \boxed{e2}\ state \\ \text{RESTR} & \boxed{e1} \langle \boxed{e2} \\ \text{HEAD} & \boxed{e1} \end{bmatrix} \\ \text{ARGSTR} & \begin{bmatrix} \text{ARG1} & \boxed{1}\ animate\text{-}ind \\ \text{ARG2} & \boxed{2}\ artifact \\ \text{D-ARG3} & \boxed{3}\ material \end{bmatrix} \\ \text{QUALIA} & \begin{bmatrix} \text{FORM} & \begin{bmatrix} \text{RELN} & exist \\ \text{ARG1} & \boxed{2} \\ \text{EVENT} & \boxed{e2} \\ \text{HEAD} & - \end{bmatrix} \\ \text{AGEN} & \begin{bmatrix} \text{RELN} & constr\text{-}act \\ \text{ARG1} & \boxed{1} \\ \text{ARG2} & \boxed{2} \\ \text{EVENT} & \boxed{e1} \\ \text{HEAD} & + \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{NONLOC|INHER|SLASH} & \{ \text{PP}_{\boxed{3}} \} \end{bmatrix}$$

Figure 1: *construir*

the process of building, it cannot appear as an argument of the result noun itself.[12]

Thus the treatment of optional complements of nominalizations is identical to the treatment assigned to D-Args of verbs. Both kinds of argument are logically implied by the semantics of the predicate (verb or noun) but are syntactically optional. They are distinguished from Pustejovsky's True-Arguments (T-Arg) –that is, the syntactically realized parameters of the lexical items (Pustejovsky, 1995:63)– by means of the syntactic level at which they are declared: in the valence list or in the set of nonlocal elements.

In order to show that other types of nominals can also be treated in this way, consider for in-

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tribute in the rest of the structures in the paper.

[11] This is expressable in LKB by using the verbal lexical entry as a *pseudo-sort* (*psort*) (see Copestake (1993:23)).

[12] Recall that creation nominals do not allow the result nominalisation with the thematic argument: **la construcció de la casa és molt sòlida* ('the building of the house is very robust').
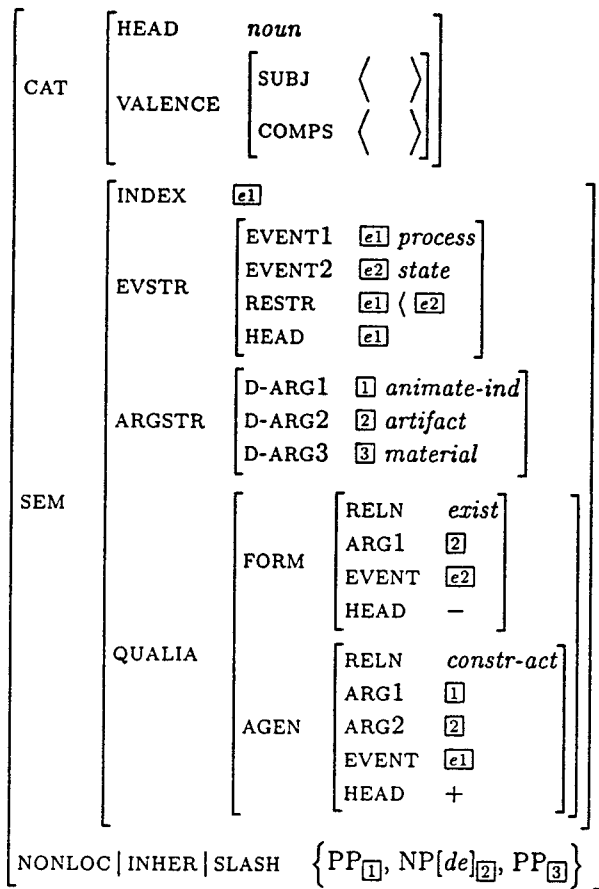
$$
\left[
\begin{array}{l}
\text{CAT} \quad
\begin{bmatrix}
\text{HEAD} & noun \\
\text{VALENCE} &
\begin{bmatrix}
\text{SUBJ} & \langle\ \rangle \\
\text{COMPS} & \langle\ \rangle
\end{bmatrix}
\end{bmatrix} \\[2em]
\text{SEM} \quad
\begin{bmatrix}
\text{INDEX} & \boxed{e1} \\
\text{EVSTR} &
\begin{bmatrix}
\text{EVENT1} & \boxed{e1}\ process \\
\text{EVENT2} & \boxed{e2}\ state \\
\text{RESTR} & \boxed{e1}\ \langle\ \boxed{e2} \\
\text{HEAD} & \boxed{e1}
\end{bmatrix} \\
\text{ARGSTR} &
\begin{bmatrix}
\text{D-ARG1} & \boxed{1}\ animate\text{-}ind \\
\text{D-ARG2} & \boxed{2}\ artifact \\
\text{D-ARG3} & \boxed{3}\ material
\end{bmatrix} \\
\text{QUALIA} &
\begin{bmatrix}
\text{FORM} &
\begin{bmatrix}
\text{RELN} & exist \\
\text{ARG1} & \boxed{2} \\
\text{EVENT} & \boxed{e2} \\
\text{HEAD} & -
\end{bmatrix} \\
\text{AGEN} &
\begin{bmatrix}
\text{RELN} & constr\text{-}act \\
\text{ARG1} & \boxed{1} \\
\text{ARG2} & \boxed{2} \\
\text{EVENT} & \boxed{e1} \\
\text{HEAD} & +
\end{bmatrix}
\end{bmatrix}
\end{bmatrix} \\[2em]
\text{NONLOC | INHER | SLASH} \quad \{ PP_{\boxed{1}},\ NP[de]_{\boxed{2}},\ PP_{\boxed{3}} \}
\end{array}
\right]
$$

Figure 2: *construcció (process reading)*

$$
\left[
\begin{array}{l}
\text{CAT} \quad
\begin{bmatrix}
\text{HEAD} & noun \\
\text{VALENCE} &
\begin{bmatrix}
\text{SUBJ} & \langle\ \rangle \\
\text{COMPS} & \langle\ \rangle
\end{bmatrix}
\end{bmatrix} \\[2em]
\text{SEM} \quad
\begin{bmatrix}
\text{INDEX} & \boxed{e1} \\
\text{EVSTR} &
\begin{bmatrix}
\text{EVENT1} & \boxed{e1}\ process \\
\text{EVENT2} & \boxed{e2}\ state \\
\text{RESTR} & \boxed{e1}\ \langle\ \boxed{e2} \\
\text{HEAD} & \boxed{e1}
\end{bmatrix} \\
\text{ARGSTR} &
\begin{bmatrix}
\text{D-ARG1} & \boxed{1}\ animate\text{-}ind \\
\text{D-ARG2} & \boxed{2}\ phys\text{-}obj \\
\text{D-ARG3} & \boxed{3}\ material
\end{bmatrix} \\
\text{QUALIA} &
\begin{bmatrix}
\text{FORM} &
\begin{bmatrix}
\text{RELN} & exist \\
\text{ARG1} & \boxed{4} \\
\text{EVENT} & \boxed{e2} \\
\text{HEAD} & -
\end{bmatrix} \\
\text{AGEN} &
\begin{bmatrix}
\text{RELN} & decor\text{-}act \\
\text{ARG1} & \boxed{1} \\
\text{ARG2} & \boxed{2} \\
\text{ARG3} & \boxed{4}\ artif \\
\text{EVENT} & \boxed{e1} \\
\text{HEAD} & +
\end{bmatrix} \\
\text{CONST} &
\begin{bmatrix}
\text{RELN} & part\text{-}of \\
\text{ARG1} & \boxed{4} \\
\text{ARG2} & \boxed{3}
\end{bmatrix}
\end{bmatrix}
\end{bmatrix} \\[2em]
\text{NONLOC | INHER | SLASH} \quad \{ PP_{\boxed{1}},\ NP[de]_{\boxed{2}},\ PP_{\boxed{3}} \}
\end{array}
\right]
$$

Figure 3: *decoració (process reading)*

stance redescription nominalizations. They differ from standard creation predicates in that their process reading cannot express syntactically the argument denoted by the result nominalization.

Consider the noun *decoració* ('decoration'), derived from the verb *decorar* ('decorate'). We start by assuming three arguments to that predicate: a first one corresponding to the agent, a second one that expresses the theme (i.e., the object being decorated), and finally a D-Arg referring to the material. The agent and the theme arguments are subcategorized as T-Args by the verb, but realized as thematically bound adjuncts when appearing in a nominalization. As opposed to *construir*, the direct object of *decorar* does not denote the object resulting from the decoration act, but the object being decorated. As a consequence both nominalisation of *decorar* (process and result) allow the

complement that corresponds to the direct object of the verb (recall that this is not possible in the case of result readings of creation predicates). Therefore the presence of the objective complement of *decoració* is not useful for disambiguating between the two readings. Thus nominalizations like *construcció* and *decoració* with the objective complement differ in that the first one does not accept the two possible senses appearing together, while the second one does. Following the treatment of Pustejovsky's dotted types in Buitelaar (1997), this fact leads us to conceive *construcció* as an open dotted type, and *decoració* as a closed dotted type.

The treatment we propose for *decoració* is

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$$
\begin{bmatrix}
\text{CAT} & \begin{bmatrix}
\text{HEAD} & noun \\
\text{VALENCE} & \begin{bmatrix} \text{SUBJ} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \end{bmatrix}
\end{bmatrix} \\[2em]
\text{SEM} & \begin{bmatrix}
\text{INDEX} & \boxed{e1} \\[1em]
\text{EVSTR} & \begin{bmatrix}
\text{EVENT1} & \boxed{e1}\ process \\
\text{EVENT2} & \boxed{e2}\ state \\
\text{RESTR} & \boxed{e1} \langle \boxed{e2} \\
\text{HEAD} & \boxed{e1}
\end{bmatrix} \\[2em]
\text{ARGSTR} & \begin{bmatrix}
\text{D-ARG1} & \boxed{1}\ animate\text{-}ind \\
\text{D-ARG2} & \boxed{2} \\
\text{D-ARG4} & \boxed{4}\ language \\
\text{D-ARG5} & \boxed{5}\ language
\end{bmatrix} \\[2em]
\text{QUALIA} & \begin{bmatrix}
\text{FORMAL} & \begin{bmatrix}
\text{RELN} & exist \\
\text{ARG1} & \boxed{3} \\
\text{EVENT} & \boxed{e2} \\
\text{HEAD} & -
\end{bmatrix} \\[2em]
\text{AGENTIVE} & \begin{bmatrix}
\text{RELN} & trans\text{-}act \\
\text{ARG1} & \boxed{1} \\
\text{ARG2} & \begin{bmatrix} \text{QUALIA} & \begin{bmatrix} info\text{-}ph\text{-}obj \\ \text{CONSTITUTIVE} & \begin{bmatrix} \text{RELN} & in\text{-}lang \\ \text{ARG1} & \boxed{2} \\ \text{ARG2} & \boxed{4} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\
\text{ARG3} & \begin{bmatrix} \text{QUALIA} & \begin{bmatrix} info\text{-}ph\text{-}obj \\ \text{CONSTITUTIVE} & \begin{bmatrix} \text{RELN} & in\text{-}lang \\ \text{ARG1} & \boxed{3} \\ \text{ARG2} & \boxed{5} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\
\text{EVENT} & \boxed{e1} \\
\text{HEAD} & +
\end{bmatrix}
\end{bmatrix}
\end{bmatrix} \\[2em]
\text{NONLOC} \mid \text{INHER} \mid \text{SLASH} & \left\{ \text{PP}_{\boxed{1}},\ \text{NP}[de]_{\boxed{2}},\ \text{PP}_{\boxed{4}},\ \text{PP}_{\boxed{5}} \right\}
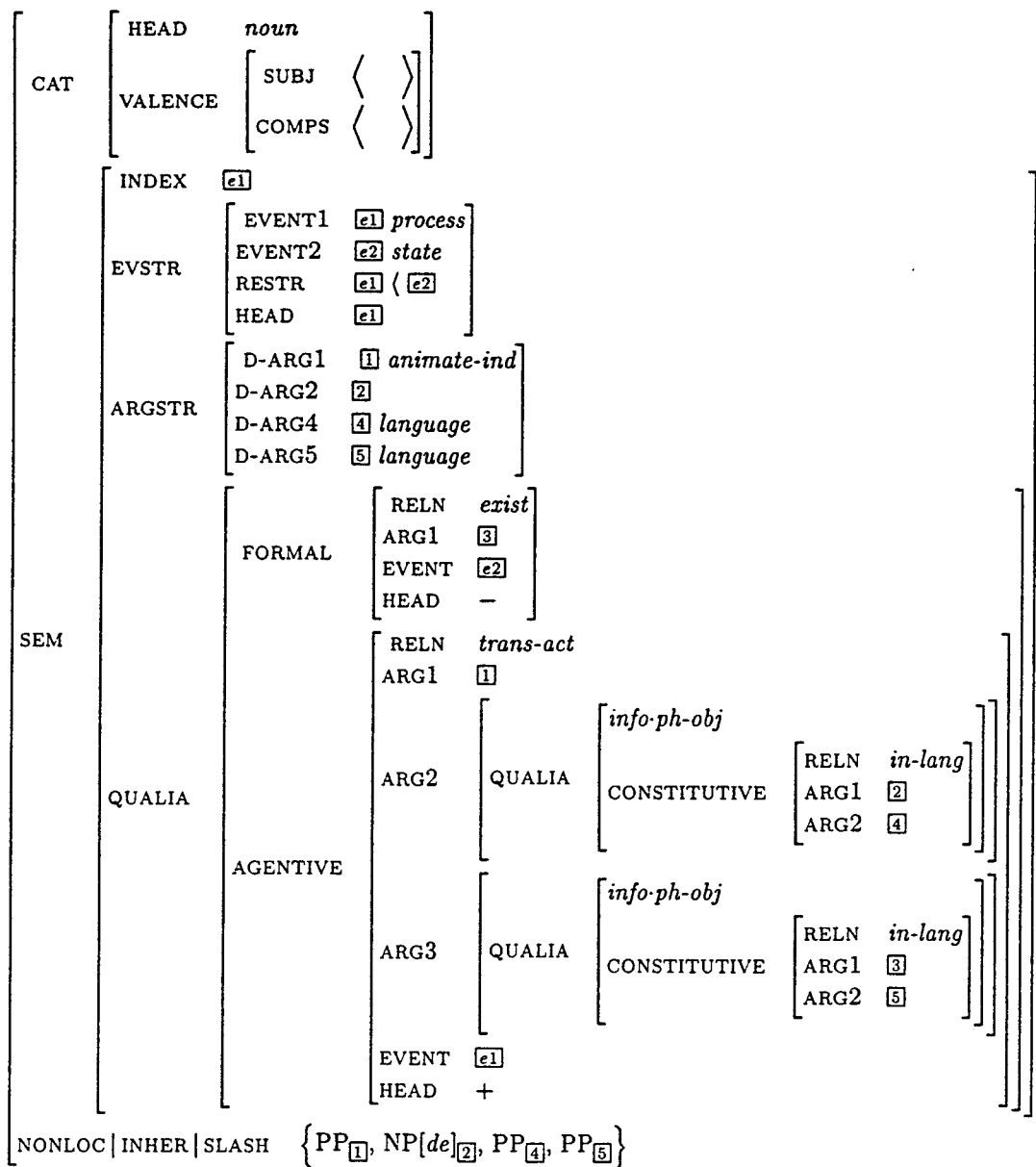\end{bmatrix}
$$

Figure 4: *traducció*

shown in figure (3). Note that it is adequate to deal with facts such as the ones exemplified in (9a). In this example the redescription nominal (*decoració*) expresses the process reading in the first clause, and in the second one it is referred to as denoting the object resulting from the process. In the representation of the nominal *decoració* in figure (3) this is allowed by the third argument of the AGENTIVE qualia, which is not bound by any argument in the ARGSTR, just because it cannot be syntactically realised in any case as an argument. Note that argument structure acts as an interface between the rich semantic representation (i.e., the QUALIA and EVSTR structures) and the surface mechanisms that allow for complements of the predicate (valence lists and non-local set). Only semantic arguments that may be syntactically realised are present in the argument structure (either as T-Args or as D- or S-Args). On the other hand the

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rich semantic structure allows to express semantically implied arguments, and thus provides a treatment for semantically motivated discourse factors (such as the ones shown in (9) above).

The proposal outlined here provides an appropriate treatment for the *traducció* example (9b). Instead of the ad hoc solution adopted in Badia (1997) the treatment proposed here derives from a general and systematic approach to the semantic structure of predicates and their nominalisations. To make things concrete we present in figure (4) the full lexical entry of the process reading of the nominal *traducció*. This representation is able to deal with anaphoric reference to the unexpressed result semantic argument of the process reading (9b). Note that a parallel verbal lexical entry also gives an account of the anaphoric relation allowed by the verb *traduir* in (9c), and that a similar treatment is applicable to the verbs *menjar* and *amanir* of examples (5) and (9e).

Of course this treatment applies in a general way to other redescription predicates, like *estudi* ('study'), *solució* ('solution') and *avaluació* ('evaluation') in (8). Notice as well that the rich semantic information we use allows us to deal in a natural way with the distinction between subjective and objective complements in these data. In (8a), for instance, *estudi* does not allow *plantes* ('plants') as the agent of the event since tha agent has to be an animate individual:[13]

Other types of nouns with semantically implied (optional) complements can be similarly treated; for example non deverbal nouns that express a relation with another entity, like nouns denoting partition or sets (*full* 'sheet' in (2) and *grup* 'group' in (3)) or relational nouns (*mare* 'mother' in (9d)). The arguments of *full* or *grup* can be treated as D-Args because they are not strictly obligatory but their semantics is implied. However the semantics of the syntactically realised complement need not correspond exactly to the semantic implication. For example, the implication of *full* realised without a complement is that it is a piece of paper; however the complement may denote any sim-

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[13]Note that in the figure for *estudi* the HEAD values of EVSTR and QUALIA levels are underspecified, similarly to the value of the INDEX attribute, thus letting the entry underspecified between the process and the result interpretation

$$
\begin{bmatrix}
\text{CAT} & \begin{bmatrix} \text{HEAD} & noun \\ \text{VALENCE} & \begin{bmatrix} \text{SUBJ} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \\[4ex]
\text{SEM} & \begin{bmatrix}
\text{INDEX} & index \\
\text{EVSTR} & \begin{bmatrix} \text{EVENT1} & \boxed{e1}\ process \\ \text{EVENT2} & \boxed{e2}\ state \\ \text{RESTR} & \boxed{e1}\ \langle\ \boxed{e2} \\ \text{HEAD} & event \end{bmatrix} \\
\text{ARGSTR} & \begin{bmatrix} \text{D-ARG1} & \boxed{1}\ animate\text{-}ind \\ \text{D-ARG2} & \boxed{2}\ top \end{bmatrix} \\
\text{QUALIA} & \begin{bmatrix} \text{FORMAL} & \begin{bmatrix} \text{RELN} & exist \\ \text{ARG1} & \boxed{3}\ info \\ \text{EVENT} & \boxed{e2} \\ \text{HEAD} & \pm \end{bmatrix} \\ \text{AGENTIVE} & \begin{bmatrix} \text{RELN} & study\text{-}act \\ \text{ARG1} & \boxed{1} \\ \text{ARG2} & \boxed{2} \\ \text{ARG3} & \boxed{3} \\ \text{EVENT} & \boxed{e1} \\ \text{HEAD} & \pm \end{bmatrix} \end{bmatrix}
\end{bmatrix} \\[4ex]
\text{NONLOC}\,|\,\text{INHER}\,|\,\text{SLASH} & \{ \text{PP}_{\boxed{1}}, \text{NP}[de]_{\boxed{2}} \}
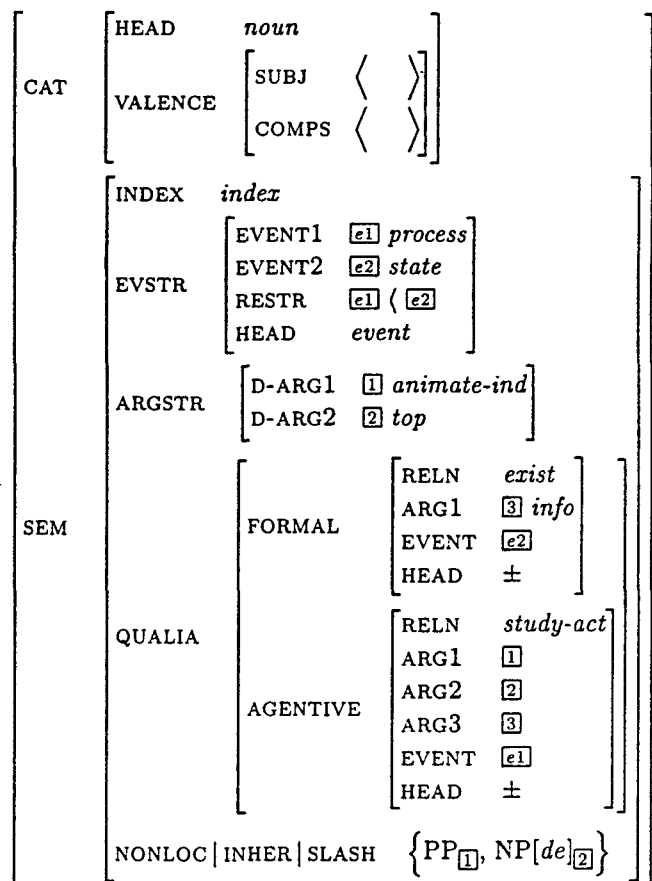\end{bmatrix}
$$

Figure 5: *estudi*

ilar class of material (card, cardboard, tissue paper...) (Saurí, 1998). We account for this difference by means of a lexical rule that over-writes the implied semantics of the complement when necessary.

This treatment however is not adequate for relational nouns, like *mare* ('mother') or *pare* ('father'). These nouns do not allow the surface realisation of the semantic implication unless it is more specific:

(10) a. *Ha vingut el pare d' un fill
         *Has come the father of a son

      b. Ha vingut el pare d' un nen
         Has come the father of a boy
         canadenc
         Canadian

      c. Ha vingut el pare de la Joana
         Has come the father of the Joana

This kind of complement can be seen as

shadow arguments (S-Arg) of Pustejovsky's. In our proposal they are treated as D-Args because they are optional: their syntactic realisation is controlled via the non-local set and the semantic implication is expressed in the FORMAL qualia. However a restriction has to be formulated upon the semantics of the syntactic element within the non-local set: namely that it be more specific than the semantic implication (see figure (6)).[14]
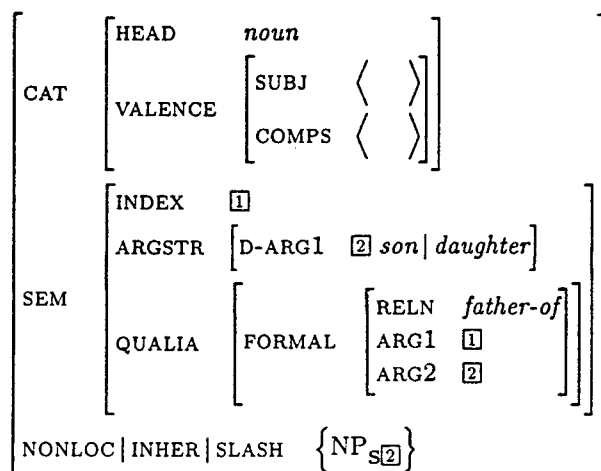
$$
\begin{bmatrix}
\text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{noun} \\ \text{VALENCE} & \begin{bmatrix} \text{SUBJ} & \langle \ \rangle \\ \text{COMPS} & \langle \ \rangle \end{bmatrix} \end{bmatrix} \\[4ex]
\text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{1} \\ \text{ARGSTR} & \begin{bmatrix} \text{D-ARG1} & \boxed{2}\ \textit{son}\,|\,\textit{daughter} \end{bmatrix} \\ \text{QUALIA} & \begin{bmatrix} \text{FORMAL} & \begin{bmatrix} \text{RELN} & \textit{father-of} \\ \text{ARG1} & \boxed{1} \\ \text{ARG2} & \boxed{2} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\[4ex]
\text{NONLOC}\,|\,\text{INHER}\,|\,\text{SLASH} & \left\{ \text{NP}_{s\boxed{2}} \right\}
\end{bmatrix}
$$

Figure 6: *pare*

5 Conclusion

In this paper we have discussed the representation of the semantic structure of nominals having complex argument structures. In particular we have proposed a treatment for syntactically unexpressed optional complements of nouns. We have shown the relevance of the representation of such relations (based on discourse factors) and have developed a treatment that takes into account both the syntactic and the semantic aspects of the phenomenon. In particular we have shown that optional complements of deverbal nominalizations and other classes of nouns (in addition of some optional complements to verbs) can be nicely dealt with by using Pustejovsky's D- and S-Args being implemented as thematically bound adjuncts in an HPSG framework semantically enriched following the lines in GL. This is possible mainly

thanks to the interface role between syntax and lexical semantic information that is performed by the argument structure level. Our proposal has been implemented by using LKB devices which allow a general and systematic treatment.

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[14]This restriction is indicated by the function "S" (i.e., specific) in the feature structure below. We are currently working on an implementation of this restriction.