Subcategorization Alternances Generation
via Lexical Rules

Mariona Taulé Delor
M. Antònia Martí Antonín
Irene Castellón Masalles

Report LSI-93-46-R
SUBCATEGORIZATION
ALTERNANCES GENERATION VIA
LEXICAL RULES

Mariona Taulé Delor, M. Antònia Martí Antonín, Irene Castellón Masalles
marionat@lsi.upc.es, amarti@lsi.upc.es, cirene@lsi.upc.es
(Universitat de Barcelona)
1.- Introduction

In current linguistic theories there is a generalized trend to the lexicalization of linguistic information. Lexicalization is understood in the sense that the majority of linguistic content dwells on the lexicon, becoming a basic component from which the majority of linguistic information may be inferred. Lexicon is no longer conceived as a mere list of entries, but as a complex and structured component.

This new focus allows both the reduction of phrase structure rules and, consequently, the simplification of the grammar. Yet, on the other hand, the information displacement to the lexicon may cause the presence of redundant information in the lexical entries. The amount and complexity of the information may also originate some problems of controlling it. In consequence, it becomes necessary not only to decide which kind of information lexical entries must contain, but also how to structure all this information in order to avoid redundancy and capture similarities between words classes which behave similarly.

Lexical Knowledge Bases (LKB) allow to effectively attack this question providing a structured representation of knowledge, where inheritance mechanisms and lexical rules avoid both redundancy and inconsistency of lexical information.

The viability of LKBs is shown in the present work\(^1\) focussing lexical rules, as a way to represent and generate linguistic information at big scale.

---

\(^1\) This work was made in the framework of the ACQUILEX-II (Esprit 7315) project at the Universitat Politecnica de Catalunya
The main goal of this paper is the treatment of Spanish verbal subcategorization alternances ("diatheses") by means of lexical rules. Different subcategorization schemes can be generated from the most basic (or general) verbal entry by applying lexical rules which show the diverse morphological, syntactic or semantic changes produced.

This work does not seek to be an exhaustive study of the different verbal diatheses that can occur in Spanish. In this sense, neither a typology nor an overall treatment of them will be provided: in this first approach only transitive alternances are discussed. The goal is to show the viability of lexical rules as an appropriate strategy to deal with subcategorization alternances in a computational lexicon.

2. – Lexical Knowledge Base

As already pointed out above the displacement of linguistic information to the lexical level can entail information redundancy in the lexical entries. An interesting proposal for clearing out this problem is the one suggested by the grammatical formalism of the "Head–Driven Phrase Structure Grammar" (HPSG) (Pollard & Sag 1987–1992), where the authors solve information redundancy by postulating Lexical types and Lexical rules.

Lexical types are feature structures which allow to hierarchically organize and classify the information according to the morphological, syntactic and semantic properties of words. (See figure 1).

Lexical rules, in turn, seek to capture linguistic generalizations between words belonging to the same lexical class. (See figures 2 and 6).

Following the theoretical approach proposed by HPSG, the Acquilex Lexical Knowledge Base\(^3\) represents objects as typed feature structures hierarchically ordered allowing inheritance of information. The basic operation of the LKB is unification. The LKB supports also lexical rules that allow to infer automatically new lexical entries from entries already present.

From the theoretical point of view, lexical rules at the LKB are based on the "generative lexicons" of J. Pustejovsky\(^1\) who considers the representation of a basic lexicon from which the rest of lexical entries is generated. In our LKB, the extension of the lexicon is

---


\(^1\) Pustejovsky, J. (1991)
accomplished by incorporating new entries or by applying lexical rules.

The kind of information represented in verbal lexical entries at the LKB is outlined below.

2.1.– Lexical representation of the verb

In our LKB, following the approach based on the sign (C. Pollard & I. Sag, 1987), a distinction is made between lexical signs (words) and phrasal signs, but in the present work we focus on lexical signs representation, and more specific on verbal signs.\(^4\)

Information included in signs is basically morpho-syntactic and semantic. Orthographical information is reduced to an orthographical sequence of the word (or phrase). Morpho-syntactic information indicates the lexical category type, the inherent morphological properties and, in the case of verbal entries, the number of arguments they subcategorize.

As for semantic information, it is specified the kind of subcategorized arguments by means of thematic roles, the selectional restrictions, as well as the verb type according to its aspectual behaviour. The structure presented by lexical signs is the following:

\[
\begin{align*}
\text{lex-sign (sign)} & \quad \text{verb-sign (lex-sign complex-sign)} \\
<\text{orth}> = \text{orth} & \quad <\text{orth}> = \text{orth} \\
<\text{cat}> = \text{cat} & \quad <\text{cat}> = \text{complex-cat} \\
<\text{sem}> = \text{sem} & \quad <\text{sem}> = \text{verb-sem} \\
<\text{sense-id}> = \text{sense-id}\hspace{1cm} & \quad <\text{sense-id}> = \text{sense-id} \\
<\text{rqs}> = \text{rqs.} & \quad <\text{rqs}> = \text{vrqs.}
\end{align*}
\]

**Figure 1: Lexical Sign and Verbal Sign.**

In the verbal sign syntactic and semantic information are integrated by coindexation of subcategorized arguments specified in \(<\text{cat}>\) and logical form arguments specified in \(<\text{sem}>\).

In the feature \(<\text{rqs}>\) semantic information is also specified. The \(<\text{vrqs}>\) includes information about the semantic class the verb belongs to (ingestion, cooking, motion, etc.).

\(^5\) The works of Castellón, I. (1992), Copestake, A. (1992), etc. present a complete treatment of nominal signs.
\(^6\) The 'sense-id' feature informs on the source dictionary, the language, the sense, etc. of the entry.
perception, diction, etc.) and about the arguments saturated at the verbal form.

3. Subcategorization alternances

We will focus here on subcategorization, concretely that referred to subcategorization alternances or verbal "diatheses". By subcategorization alternances or "diatheses" we understand the different realizations (alternances) to express the arguments of a verb, that is, the different subcategorization schemes to combine the arguments where a certain verb can appear.

The kind of verbal "diatheses" treated along this work are the following: transitive construction, passive, "reflexive passive", intensifier pronominal use, reflexive, intransitive construction and ergative pronominal use.

The "reflexive passive" is a specifically Spanish construction similar to passive, in the sense that in both of them the internal argument of the active construction becomes patient subject. The difference between both constructions resides on:

a) verbal form: in "reflexive passive" the clitic "se" (always in third person) is added to the verb, whereas in passive form the verb is a periphrasis formed by the verb "ser" ('to be') plus the past participle.

b) involved arguments: in the "reflexive passive", unlike the passive, the agent of the action is undetermined, superficially unexpressed. In the passive construction the agent can also be eluded, but it is implicit into the verbal flexion (for instance, (2b) El pan es tostado por Toni, 'Bread is toasted by Tony' vs. (2c') El pan es tostado, 'Bread is toasted'). In the "reflexive passive" the agent is not expressed: the sentence (2c') *Se tuesta el pan por Toni, 'Bread is toasted by Toni' is incorrect in Spanish.

In the intensifier pronominal use, a clitic ("me, te, se, nos, os") is added to the verb agreeing in number and person to the verb, but in these constructions the clitic has no argumenal value. Rather, it is just an emphatic or intensifier mark.

Reflexive use indicates that the subject and the direct (or indirect) complement of the expression are identical, that is, correferent. The reflexive clitic agrees in number and person to the verb.

The ergative pronominal use is, from a syntactic point of view, equal to the "reflexive passive" constructions: the verb agrees in number and person to the subject, and the clitic.

---

*In the work Towards a VROS Representation it is presented more completely the description of the information contained into the <vrrs> (forthcoming).
added to the verbal root, is always in third person. Yet, in the "reflexive passive" constructions the subject is generally postponed to the verb, whereas in the ergative pronominal use it is placed before. The difference between one and the other is mainly semantic: verbs appearing in the ergative pronominal use become completely "descausativized", that is to say, the causing of the action is not expressed neither explicitely nor implicitly. Neither in the "reflexive passive" constructions the causing of the action is explicitely expressed, but it is indeed implicitely present or it is easily inferable.

Let's see below some examples of alternance on the subcategorization schemes:

(1) a. Clara come un huevo frito con patatas. (Active Transitive Construction)
   b. Un huevo frito con patatas es comido por Clara. (Passive)
   c. Se come un huevo frito. (Reflexive Passive)
   d. Clara se come un huevo frito con patatas. (Intensifier Pronominal Use)
   e. * Clara se come. (Reflexive)
   f. Clara come. (Intransitive Construction)
   g. ?? Un huevo frito se come. (Ergative Pronominal Use)

(2) a. Toni tuesta el pan. (Active Transitive Construction)
   b. El pan es tostado por Toni. (Passive)
   c. Se tuesta el pan. (Reflexive Passive)
   d. Toni se tuesta el pan. (Intensifier Pronominal Use)
   e. * Toni se tuesta. (Reflexive)
   f. ?? Toni tuesta. (Intransitive Construction)
   g. El pan se tuesta. (Ergative Pronominal Use)

(3) a. Laura emborracha a Manuel. (Active Transitive Construction)
   b. Manuel es emborrachado por Laura. (Passive)
   c. * Se emborracha Manuel. (Reflexive Passive)
   d. * Laura se emborracha a Manuel. (Intensifier Pronominal Use)
   e. Manuel se emborracha. (Reflexive)
   f. * Manuel emborracha. (Intransitive Construction)

(4) a. Alicia ha roto el vaso. (Active Transitive Construction).
   b. El vaso ha sido roto por Alicia. (Passive)
   c. Se ha roto el vaso. (Reflexive Passive)
   d. *Alicia se ha roto el vaso. (Intensifier Pronominal Use)
   e. *Alicia se ha roto (Reflexive)
   f. *Alicia ha roto. (Intransitive Construction)
   g. El vaso se ha roto. (Ergative Pronominal Use)
The verbs "comer" (to eat), "tostar" (to toast), "emborrachar" (to intoxicate), and "romper" (to break) from the sentences (1), (2), (3) and (4) can follow different syntactic patterns. Incorrect constructions are due to diverse causes, like semantic class of the verb, characteristics of the subcategorized arguments (whether the argument is determined or undetermined, etc.), selectional restrictions (whether the argument is human or innanimate, etc.). The link between the "diatheses" and the verbal semantic classes constitute one of the researching subjects which are being developed today. The present work focused mainly on the rules of "diatheses" generation and, therefore, we don't deal at deep to explain about a verb admits one type of alternance and refuses another one.

All verbs in the example sentences share the fact of accepting transitive construction and, consequently, they also admit the use of passive. The only verb which does not alternate neither with the "reflexive passive" construction nor with the intensifier pronominal use is "emborrachar" ('to intoxicate'); it also differentiates itself from the rest of the mentioned verbs by the fact that it is the only one accepting the reflexive use. Evidently, this coincidence is not unfounded: at the verb "emborrachar", when used transitively, both the subject agent of the action and the patient are human and referentially different. Whereas in the reflexive use the agent and the patient (pronominally expressed now) are correferents, they are the same person. In fact, the reflexive use, somehow, blocks the rest of possible alternances, the intransitive as well as the intensifier pronominal use and the "reflexive passive". On the other hand, the only verb which admits alternance with the intransitive construction is the verb "comer" (to eat), maybe because in this kind of verbs the patient is very lexicalized and it is easily inferable.

The ergative pronominal use in verbs like "comer" is very forced, if not assisted by a modal or instrumental complement (e.g. (1g') El huevo frito se come con tenedor, 'The fried egg is eaten with fork'), with it becomes a statement of a general kind implying a change of meaning. The verb "romper" (to break) neither admits the intensifier pronominal use.

It is important to point out the complexity the presence of clitics in Spanish verbal constructions entail, because they suppose very different uses, as it is demonstrated at the example sentences mentioned before. The basic distinction is whether the clitic may have an argumental value, like in the case of reflexive use, or it simply is a lexical mark added to the verb, like in the cases of "reflexive passive", intensifier pronominal use, and ergative pronominal use.

The alternances appearing at the mentioned examples not only reflect changes at a syntactic level, that is, on the number and kind of arguments subcategorized by the verb, but

---

they also entail changes on the expression of the implied thematic roles, changes at a morphological level and they even may imply changes at an aspectual level. For instance, in the sentence (1f) there is a syntactic omission of the patient argument (though it is rightly inferable) which supposes an aspectual change; the sentence (1a) has an accomplishment reading (the process has a logical culmination) whereas the sentence (1f) indicates a process. The presence of the clitic in the sentence (1d), moreover its emphasizing function, supposes a change at the morphological level, a pronoun is added to the verb, that is, the verb becomes pronominalized. The sentence (2) alternates a causative reading (2a), where the causative agent argument is explicated, in front of a non-causative (or inchoative) reading, where the causing of the action is not expressed because it has no interest (2g). In the sentence (3e), the causing agent of the action and the patient are the same ('Manuel'), in front of the sentence (3a), where such an identification does not happen. Thus, there is a change in the expression of the involved thematic roles.

Subcategorization alternances imply changes at morphological, syntactic and semantic levels. This means that the "diatheses" should not be treated exclusively from a syntactic point of view. The "diatheses" is, somehow, the interaction between the information referred to meaning (thematic roles and selectional restrictions) and the syntactic realization of these arguments, as B. Levin (1989) points out. B. Levin's proposal is based on the idea that a good classification of the grammatical alternances can serve of aid for classifying the meaning of verbs on distinct semantic classes.

All this information related to alternances must be represented in the lexical entry, in which all the changes and links implied at syntactic and semantic levels must be expressed. A main point is how to represent all this information. Our approach use lexical rules.

3.1.-- Lexical rules

Basically, there are two possible strategies to represent subcategorization alternances in a LKB:

a) To create as many lexical entries as subcategorization schemes a given verb admits. To adopt this strategy supposes, firstly, an increase in the number of entries in the LKB, the unnecessary repetition of lexical information and, finally, that links between entries of the same verb are not expressed.

b) The other possible strategy, followed here, is the expression of the subcategorization alternances by lexical rules (Sanfilippo 1992). With this method we need to create a unique verbal entry, the one considered the most basic or general, from which the rest of possibilities

---

4 The present work follows the research lines proposed in Levin (1989), as far as treatment and classification of subcategorization alternances are concerned.
are generated. Thus, the amount of lexical entries is reduced while redundancy of information is eliminated and the different syntactic and semantic behaviors are formally captured.

Following this proposal, the need arises to determine which alternance scheme is the most basic or general. Our proposal considers, in principle, the verbal entry subcategorizing the largest number of arguments (generally the most informative) as the most basic entry.

Lexical rules are defined in the LKB in terms of features structures. Their consist on an input lexical sign (\(<1>\)) which gives as a result a new output lexical sign (\(<0>\)) (See figure 2). In the case studied here, the input lexical sign is verbal and the result is a new verbal sign.

\[
\text{lexical-rule (rule)*} \\
\quad \langle1\rangle = \text{lex-sign} \\
\quad \langle0\rangle = \text{lex-sign}.
\]

**Figura 2: Lexical Rule**

*(Information in brackets refers to the hyperonym of the type in the hierarchy, the type 'lexical rule' is hyponym of the type 'rule'.)*

3.2. "Diatheses" representation in the LKB

In this section we discuss the way verbal "diatheses" are represented in the LKB, the lexical rules we have developed and their instantiation.

Figure 3 shows a partial view of the lexical rules of the LKB’s type structure. The represented rules account for the subcategorization alternances we name as transitive: intensifier pronominal use ('trans-intens-alt'), reflexive use ('trans-reflex-alt'), "reflexive passive" ('pass-refl-alt'), ergative pronominal ('erg-prnl-alt'), object omission\(^{10}\) ('indef-def-alt') and passive ('pass-alt').

\(^{10}\) In Spanish the elision of the explicit subject is often made because it is morphologically expressed at the verbal forms. In a future development we will include a "diatheses" rule dealing with the subject elision.
Figura 3: Types Hierarchy: rules

At the top of the rules hierarchy we have the most general type ('rule') which is further classified on two rules types, lexical ones ('lexical–rule') and grammatical ones ('grammar–rule'). A subtype of lexical rule is the transitive alternance rules ('trans–alt'), characterized for having a transitive verb as input lexical sign ('strict–trans–sign'). The 'trans–alt' type includes the majority of verbs, because all verbs admitting intransitive uses can be inferred by means of "diatheses" lexical rules from its corresponding transitive use. By 'intrans–alt' only strictly intransitive verbs are treated, those which never admit a transitive use. The kind of "diatheses" these strictly intransitive verbs allow is limited to the presence or absence of oblique complements.

Within the transitive alternances ('trans–alt') several rules are distinguished ('trans–prnl–alt', 'trans–intrans–alt', 'trans–obl–alt', etc.) depending on the output lexical sign they generate.

The 'trans–prnl–alt' rule type imply no category change, that is, it maintains the same output lexical sign ('strict–trans–sign') and the same number of subcategorized arguments. This type includes two different rules ('trans–intens–alt' and 'trans–reflex–alt'), each one express the different changes these constructions entail.
In the case of the intensifier pronominal use rule 'trans-intens-alt', only one change is produced at a morphological level: the pronominal clitic is added to the verbal form (e.g.: (1d) Clara se come un huevo frito con patatas, ‘Clara eats a fried egg with chips’ vs. (1a) Clara come un huevo frito con patatas, ‘Clara eats a fried egg with chips’) which has no function but that of emphasis.

The 'trans-reflex-alt' rule accounts for constructions which allow reflexive use (e.g.: (3e) Manuel se emborracha, ‘Manuel becomes intoxicated’ vs. (3a) Laura emborracha a Manuel, ‘Laura intoxicates Manuel’); this use implies both a change on the type of object argument, which becomes a pronominal clitic, and a semantic change. In the reflexive use identification between agent argument and patient always happen, they are correferent. Correference which is not established in the active transitive construction.

The clitic of both constructions ((1d) and (3e)) is declinated with the verb agreeing in number and person.

Rules defined into the 'trans-intrans-alt' type show the omitted argument and, consequently, they generate signs from an unique argument, that is, intransitive signs. The kind of change produced resides on the number of subcategorized arguments which can also imply changes at a morphological and semantic level. Within this type two rule groups can be distinguished:

a.) that omitting patient argument 'indef-def-alt' (e.g.: (1f) Clara come, ‘Clara eats’ vs. (1a) Clara come un huevo frito con patatas, ‘Clara eats a fried egg with chips’);

b.) and that omitting agent argument, the “reflexive passive” rule ‘pass-refl-alt’ (e.g.: (2c) Se tuesta el pan, ‘Bread is toasted’ vs. (2a) Toni tuesta el pan, ‘Toni toaste bread’) and, on the other side, ergative pronominal rule ‘erg-prnl-alt’ (e.g.: (4g) El vaso se ha roto, ‘The glass was broken’ vs. (4a) Alicia ha roto el vaso, ‘Alicia broke the glass’) which jointly to the argumental change implies a change at a morphological level with the introduction of the pronominal clitic "se" into the verbal form, which in these constructions is always used in third person. The difference between this two last rules is mainly semantic: in the pronominal ergative constructions there is a 'descausativization' of the action whereas in the “reflexive passive” there is not. Though the cause which produces the action in “reflexive passive” is not expressed, it is easily inferable.

Finally, the ‘trans-obl-alt’ type includes those rules producing an oblique sign as an output lexical sign, that is, a sign which subcategorizes a prepositional argument. The passive ‘pass-alt’ rule might illustrate this type of rules (e.g.: (1b) Un huevo frito con patatas es comido por Clara, ‘A fried egg with chips is eaten by Clara’ vs. (1a) Clara come un huevo frito...
con patatas, ‘Clara eats a fried egg with chips’), which imply a change on the verbal argumentation; this change is not necessary on the number of subcategorized arguments, but on the type of implied arguments, besides a change at a morphological level on the verbal form. These rules imply a restructuration of the arguments.

Subcategorization alternances are introduced at a syntactic level (that is, in <cat>) through the <diatheses> feature, which has as value the 'alternations' type. A subclassification of the different alternance types which can be found is defined from the 'alternations' type. In figure 4 a sample is given.

![Diagram of Types Hierarchy: Subcategorization alternances.]

Next the “reflexive passive” lexical rule is illustrated with its application to the verbal entry "tostar X_I_1".

In figure 5 the lexical entry "tostar X_I_1" is introduced with a verbal sign from the 'strict–trans–sign' type.

The category, 'strict–trans–cat', is specified at the <cat> feature, as well as the arguments subcategorized by the verb. In the <m–feats> (morphological–feats) feature information on verbal form (<vform>), governed prepositions (<prt>), etc. are included, as well as information on subcategorization alternances (<diatheses>). In the case of the verb 'tostar', the “diatheses” type is transitive ('strict–trans–diatheses') and the alternances type it can present are included into the <trans–alt> feature: the “reflexive passive” ('passrefl'), the passive ('pass'), the intensifier pronominal use ('prnlintens') and the ergative pronominal use ('prnlerg'), which will allow the application of the corresponding lexical rules ('pass–refl–alt', 'pass–trans–refl–alt', 'prnlintens')
'pass-alt', 'trans-intens-alt' and 'erg-prnl-alt' respectively).

At the <sem> feature the argumental structure of the verb "tostar" is specified by means of a binary logical form, which indicates that the verb "tostar" in its transitive use is an 'accomplishment' ('qua-eve'), the first argument is a human agent, indicated both by the proto-role 'p-agt-cause' and the selectional restriction 'e-human', and the second argument is a patient with proto-role 'p-pat-affected' which taking as a value the selectional restriction 'e-inanimate'.

Figure 5: Lexical Entry "tostar X/J/1"

In the figure 6 the lexical rule of "reflexive passive" ('pass-refl-alt') is presented. One can compare there the input (<1>) and output (<0>) lexical signs which reflect the changes produced on <orth>, <cat> and <sem>.

The first change observed is on the <orth> feature introducing the pronoun 'se', which implies a complex orthography of the resulting sign (<0>).
The "reflexive passive" rule makes a transitive sign 'strict--trans--sign' (<1>) become an intransitive sign 'strict--intrans--sign' (<0>), in which it has been omitted the human agent argument causing of the action ('p--agt--cause') of the transitive construction. The value 'passrefleja' is also specified for the <vform> feature.

**Figure 6: Lexical Rule for “Reflexive Passive”**

This rule has also repercussions on the argumental structure, the agent argument of the construction in “reflexive passive” is a 'p--agt'. In figure 7 changes on the <sem> feature can be observed:
Figura 7: Aplicación del "Reflexive Passive" Rule on "tostar"

In the new lexical entry different changes produced on <orth>, <cat> and <sem> can be seen. Innanimate patient 'p–pat–affected' of the active transitive construction is now, at the "reflexive passive" construction, the innanimate agent 'p–agt'. The human agent causing of the action of the transitive form 'p–agt–cause' is not expressed at the "reflexive passive" construction.

Appendix 1 gives a sample of lexical rules of transitive "diatheses" included on the LKB.
5. Conclusions

The six lexical rules of transitive alternances developed up to now cover, in principle, all the Spanish verbs admitting these kind of constructions.

From the morpho-syntactic point of view the rules give account of the morphological changes produced in the verbal form and also of the changes of category and subcategorized arguments. Referring to semantic information, rules also give account of the changes produced in the thematic roles and selectional restrictions.

One of the problems outlined is the optionality of complements (for instance, in passive construction the prepositional argument agent is optional). Currently, we solve it postulating two passive rules: one for the passive with an agent PP and another one for the passive where the agent is not specified. The Spanish elliptic subject poses the same problem.

We can conclude that the treatment of the subcategorization alternances by means of the application of lexical rules is a good strategy for representing information in a LKB. Lexical rules are a valid mechanism which avoids information redundancy and allows the establishment of links and generalizations on the lexical entries.

The organization of the lexical alternance rules in a type hierarchy contributes in the Spanish studies of subcategorization alternances in two ways: we generate the verbal subcategorization postulating lexical rules that implies a formalization of these phenomena and, also, we give a classification of the subcategorization alternances.

Future research lines will be focused on three concrete issues:

1. Lexical rules enlargement, in order to embrace the whole amount of subcategorization alternances allowed in Spanish.

2. Study of alternances with reference to verbal semantic classes, following the theoretical approach proposed by B. Levin (1989).

3. Definition of tlinks between classes of lexical rules in order to establish the translation equivalences between syntactic phenomena as verbal diatheses.
Appendix I: Lexical Rules of Transitive Diatheses.

rule (top)
< 0 > = sign
< 1 > = sign.

grammar-rule (rule)
< 0 > = sign
< 1 > = sign
< 2 > = sign.

lexical-rule (rule)
< 0 > = lex-sign
< 1 > = lex-sign.

trans-alt (lexical-rule)
< 1 > = strict-trans-sign
< 0 : rqs> = < 1 : rqs>.

trans-obl-alt (trans-alt)

obl-intr-alt (trans-obl-alt)
< 0 > = obl-intrans-sign
< 0 : sem : arg2 : arg2 : arg2> = < 1 : sem : arg2 : arg1 : arg2>

trans-prn1-alt (trans-alt)
< 0 > = strict-trans-sign
< 0 : orth : orth2> = < 1 : orth>
< 0 : cat : result : result : m-feats : vform> = < 1 : cat : result : result : m-feats : vform>
< 0 : cat : result : result : m-feats : prn1> = pronominal.

trans-intrans-alt (trans-alt)
< 0 > = strict-intrans-sign
< 0 : cat : result : m-feats : prn1> = < 1 : cat : result : result : m-feats : prn1>

unexp-alt (trans-intrans-alt)
unexp-ag-alt (trans-intrans-alt)
<1 : orth> = <0 : orth : orth2>
<0 : orth : orth1> = "se"
<0 : sem : arg2 : pred> = p-agt

indef-def-alt
unexp-alt
<1 : orth> = <0 : orth>
<1 : cat : result : result : m-feats : diatheses : trans-alt> = "indef-def"
<0 : sem : arg2 : pred> = <1 : sem : arg2 : arg1 : pred>

trans-reflex-alt
trans-prnl-alt
<0 : orth : orth1> = <0 : cat : active : orth>
<0 : cat : active : cat : m-feats : agr> = <0 : cat : result : result : m-feats : agr>
<0 : cat : active : cat : m-feats : nominal-form> = pronoun
<1 : cat : result : result : m-feats : diatheses : trans-alt> = "reflex"
<0 : sem> = <1 : sem>.

trans-intens-alt
trans-prnl-alt
<1 : cat : result : result : m-feats : diatheses : trans-alt> = "prnlintens"
<0 : sem> = <1 : sem>.

pass-refl-alt
unexp-ag-alt
<0 : cat : result : m-feats : vform> = passrefija
<1 : cat : result : result : m-feats : diatheses : trans-alt> = "passrefl".

erg-prnl-alt
unexp-ag-alt
<0 : cat : result : m-feats : vform> = ergativeprnl
<1 : cat : result : result : m-feats : diatheses : trans-alt> = "prnlerg".
pass-alt
obl-intr-alt
  <0 : orth : orth1> = "ser"
  <0 : orth : orth2 : orth1> = <1 : orth>
  <0 : orth : orth2 : orth2> = "+do"
  <0 : cat : result : result : m-feats : vform> = pass
  <1 : cat : result : result : m-feats : diatheses : trans-alt> = "pass"
  <0 : cat : result : result : m-feats : prnl> = <1 : cat : result : result : m-feats : prnl>
  <0 : sem : arg2 : arg1 : pred> = p-agt
  <0 : sem : arg2 : arg2 : pred> = "por".
References

Acquilex-II. The Acquisition of Lexical Knowledge, Basic Research Project 7315
ACQUILEX-II, Technical Annexex.
Ageno, A., I. Castellón, M.A. Martí, F. Ribas, G. Rigau, H. Rodríguez, M. Taulé, M.F.
Verdejo, “SEISD: An Enviroment for Extraction of Semantic Information from On-line
Dictionaries” in Proceedings of the 3rd Conference on Applied Natural Language
Castellón, L., Lexicografía Computacional: Adquisición de Conocimiento Léxico. Tesis
Copestake, A. “The ACQUILEX LKB: Representation Issues in Semi-Automatic Acquisition
of Large Lexicons”. Proceedings of the 3rd Conference on Applied Natural
Language Processing, 1992.
Dowty, D. “Thematic Proto Roles, Subject Selection and Lexical Semantic Defaults”,
Dowty, D. “On the Semantic Content of the Notion ‘Thematic Role’, in Chierchia, G., Partee,
B. & Turner, R. (eds) Property Theory. Type Theory and Natural Language. Dordrecht:
Pollard, C. & Sag, I., Agreement, Binding and Control: Information-Based Syntax and
Sanfilippo, A. “LKB Encoding of Lexical Knowledge”. Briscoe, T., Copestake, A., & de
Sanfilippo, A. “Verbal Diatheses: Knowledge Acquisition, Lexicon Construction and Dictionary
Equivalence and Lexicalization in the ACQUILEX LKB” Proceedings of the 4th I
International Conference on Theoretical and Methodological Issues in Machine
Translation, 1992.
Uszkoreit, H. “Categorial Unification Grammar” Proceedings of the 11th International
Conference on Computational Linguistics and the 24th Annual Meeting of the
Association for Computational Linguistics, 1986.
List of research reports (1993).

LSI-93-1-R "A methodology for semantically enriching interoperable databases", Malú Castellanos.

LSI-93-2-R "Extraction of data dependencies", Malú Castellanos and Fèlix Saltor.

LSI-93-3-R "The use of visibility coherence for radiosity computation", X. Pueyo.

LSI-93-4-R "An integral geometry based method for fast form-factor computation", Mateu Sbert.

LSI-93-5-R "Temporal coherence in progressive radiosity", D. Tost and X. Pueyo.

LSI-93-6-R "Multilevel use of coherence for complex radiosity environments", Josep Vilaplana and Xavier Pueyo.

LSI-93-7-R "A characterization of $P^N_{NP} = P^N_{NP[log]}$, Antoni Lozano.

LSI-93-8-R "Computing functions with parallel queries to NP", Birgit Jenner and Jacobo Torán.


LSI-93-10-R "Parallel approximation schemes for problems on planar graphs", Josep Díaz, María J. Serna, and Jacobo Torán.

LSI-93-11-R "Parallel update and search in skip lists", Joaquim Gabarró, Conrado Martínez, and Xavier Messegueur.

LSI-93-12-R "On the power of Equivalence queries", Ricard Gavaldà.

LSI-93-13-R "On the learnability of output-DFA: a proof and an implementation", Carlos Domingo and David Guitjarro.

LSI-93-14-R "A heuristic search approach to reduction of connections for multiple-bus organization", Patricia Ávila.

LSI-93-15-R "Toward a distributed network of intelligent substation alarm processors", Patricia Ávila.

LSI-93-16-R "The Odissea approach to the design of information systems from deductive conceptual models", Maria Ribera Sancho and Antoni Olivé.

LSI-93-17-R "Constructing face octrees from voxel-based volume representations", Robert Juan i Ariño and Jaume Solé i Bosquet.


LSI-93-40-R "How to know it all (or how to get rid of logical omniscience and perfect reasoners)", Ton Sales.

LSI-93-41-R "On adaptive dlogtime and polylogtime reductions", Carme Álvarez and Birgit Jenner.

LSI-93-42-R "Polylogtime and logspace adaptive reductions", Carme Álvarez.


LSI-93-44-R "The $P_{log^r}$ and $AC^{r-1}$ operators on the polynomial time hierarchy", Jorge Castro and Carlos Seara.


LSI-93-48-R "Translation equivalence via lexicon: a study on tlinks", Anna Samiotou, Irene Castellón, Francesc Ribas, and German Rigau.

LSI-93-49-R "A class-based approach to learn appropriate selectional restrictions from a parsed corpus", Francesc Ribas.

Internal reports can be ordered from:

Nuria Sánchez
Departament de Llenguatges i Sistemes Informàtics (U.P.C.)
Pau Gargallo 5
08028 Barcelona, Spain
securelsi@lsi.upc.es