

An Account of Selection Restrictions in Role and Reference Grammar*

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0. Abstract

Selection restrictions have been a much debated issue since their first appearance in Generative Grammar (Katz and Fodor). Many scholars have dealt with them from a variety of theoretical stances: from syntactic perspectives, for example, Chomsky, to more semantic approaches, such as Weinreich and Coseriu, as well as cognitive ones, like Taylor, to name just a few. Within Role and Reference Grammar (RRG; Van Valin; Van Valin and LaPolla), selection restrictions are not expressed directly in logical structures but are stipulated on an *ad hoc* basis, since there is not yet a lexico-semantic representation that provides a full decomposition of these aspects of meaning. We sustain that a solution may be found if the current RRG semantic representations stored in the lexicon are linked to conceptual information stored in the Ontology of a lexico-conceptual knowledge base such as FunGramKB (Mairal and Periñán “The Anatomy”, “Teoría lingüística”; Periñán and Arcas “Meaning Postulates”, “Microconceptual-Knowledge”, “Cognitive Modules”, “Deep Semantics”; Periñán and Mairal “Bringing”, “La gramática de COREL”). The goal of this paper is to explore how selection restrictions can be easily incorporated in the Ontology in the form of conceptual schemata like thematic frames (TFs) and meaning postulates (MPs).

These, in turn, will be connected to the RRG logical structures via conceptual logical structures, which are abstract representational mechanisms that bridge the gap between the cognition-oriented TFs and MPs in the Ontology, and the particular lexico-syntactic idiosyncrasies represented in logical structures (Periñán and Mairal “Bringing”). As for selection restrictions, or selectional preferences, they are stated in TFs and MPs when they exert constraints typically related to the cognitive situations displayed by the events. The domain of POSSESSION is employed to illustrate this kind of preferences within an ontology.

Keywords: selection restrictions, Role and Reference Grammar, selectional preferences, FunGramKB, possession.

Las restricciones de selección han sido un tema muy debatido desde su primera aparición en la Gramática Generativa (Katz y Fodor). Muchos estudiosos se han ocupado de ellas desde distintas posturas teóricas: desde planteamientos sintácticos como, por ejemplo, Chomsky, hasta enfoques más semánticos, como Weinreich y Coseriu, así como desde una perspectiva cognitiva, como Taylor, por nombrar sólo algunos. Dentro de la Gramática del Papel y la Referencia (GPR; Van Valin; Van Valin y Lapolla), las restricciones de selección no se expresan directamente en las estructuras lógicas, sino que se establecen ad hoc, ya que aún no existe una representación léxico-semántica que proporcione una descomposición completa de estos aspectos del significado. Sostenemos que la solución se puede encontrar si las actuales representaciones semánticas de la GPR almacenadas en el léxico se vinculan a la información conceptual almacenada en la ontología de una base de conocimiento léxico-conceptual como FunGramKB (Mairal y Periñán “The Anatomy”, “Teoría lingüística”; Periñán

y Arcas “Meaning Postulates”, “Microconceptual-Knowledge”, “Cognitive Modules”, “Deep Semantics”; Perrián y Mairal “Bringing”, “La gramática de COREL”). El objetivo de este trabajo es explorar cómo las restricciones de selección pueden ser fácilmente incorporadas a la ontología en forma de esquemas conceptuales como son los marcos temáticos (MMTT) y los postulados de significado (PPSS). Éstos, a su vez, estarán conectados a las estructuras lógicas de la GPR a través de las estructuras lógicas conceptuales, que son unos mecanismos abstractos de representación que hacen de puente entre los MMTT y los PPSS de la ontología, y las idiosincrasias léxico-sintácticas recogidas en las estructuras lógicas (Perrián y Mairal “Bringing”). En cuanto a las restricciones de selección o preferencias de selección, se expresan en los MMTT y en los PPSS cuando ejercen constreñimientos normalmente relacionados con las situaciones cognitivas mostradas por los eventos. Se muestra el dominio de la posesión para ilustrar este tipo de preferencias dentro de una ontología.

Palabras Clave: restricciones de selección, Gramática del Papel y la Referencia, preferencias de selección, FunGramKB, posesión.

1. Introduction

Selection restrictions have been a much debated issue since their first appearance in Generative Grammar in Katz and Fodor. Many scholars have dealt with them from a variety of theoretical stances: from syntactic perspectives, for example, Chomsky, to more semantic approaches, such as Weinreich and Coseriu, as well as cognitive ones, like Taylor, to name just a few. Within Role and Reference Grammar (hereafter RRG; Van Valin; Van Valin and LaPolla), selection restrictions are not expressed directly in logical structures but are

stipulated on an *ad hoc* basis. For example, there is a general lexical principle to account for the fact that the first argument in the logical structure of verbs of perception, cognition, propositional attitude, emotion and internal experience must be a sentient, animate entity (Van Valin and LaPolla 156). This is certainly so because there is not yet a lexico-semantic representation that provides a full decomposition of all these aspects of meaning, since the idea is that “the RRG semantic representation would ultimately have to be given a full interpretation in a formal semantic theory” (Van Valin 50).

The goal of this paper is to present selection restrictions from a conceptualist framework such as the lexico-conceptual knowledge base *Functional Grammar Knowledge Base* (FunGramKB¹ henceforth; Mairal and Perriñán “The Anatomy”, “Teoría lingüística”; Perriñán and Arcas “Meaning Postulates”, “Microconceptual-Knowledge”, “Cognitive Modules”, “Deep Semantics”, “The Architecture”, “Ontological Commitments”; Perriñán and Mairal “Bringing”, “La gramática de COREL”), specifically, its Ontology or the module where semantic knowledge is stored. We believe that, if the current RRG semantic representations - stored in the lexicon - are linked to the conceptual information stored in the FunGramKB Ontology, the *ad hoc* stipulations previously mentioned could be dispensed with.

The article is structured as follows. In section 2, concepts such as *collocation* and selection *restriction* are discussed within the context of FunGramKB. In section 3, the cognitive domain of POSSESSION is employed to exemplify the most relevant selectional constraints captured in the basic concepts (subsection 3.1), terminal concepts (subsection 3.2), and subconcepts (subsection 3.3) of this dimension. In subsection 3.4, we also detail how the selectional preferences

coded in these three types of concepts are arrived at and where collocations are incorporated in FunGramKB. Finally, some conclusions are provided in section 4.

2. The Concepts of Collocation and Selection Restriction within FunGramKB

As Mairal and Periñán ("The Anatomy" 220) point out, FunGramKB is made up of three information levels (see Figure 1):

- i) Lexical level = linguistic knowledge
- ii) Grammatical level = linguistic knowledge
- iii) Conceptual level = non-linguistic knowledge

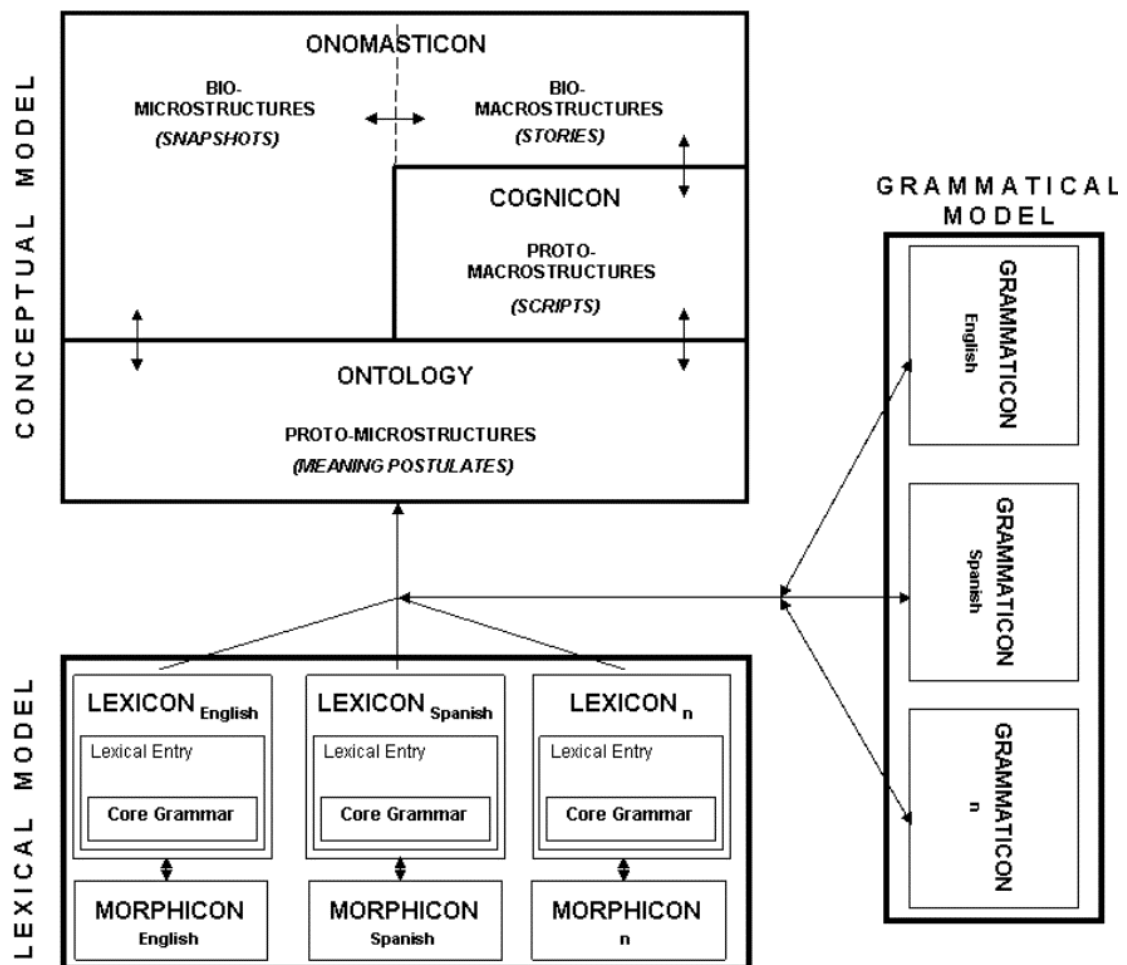


Fig. 1. FunGramKB modules (at www.fungramkb.com)

Each of these information levels in turn consists of several independent but interrelated modules. The *lexical level* comprises a) the various lexica (e.g. English, Spanish, Italian, German, etc.),² which store morphosyntactic, pragmatic and collocational information about lexical units, preserving the major linguistic assumptions of RRG – logical structures, macroroles, and so forth –, and b) the Morphicon, which handles cases of inflectional morphology. The *grammatical module* or Grammaticon is currently being developed within the Lexicom group. Its function is to capture the properties that are specific to the most relevant constructional families in the languages under consideration in the Ontology which, so far, are English and Spanish. The *conceptual level* consists of three modules: a) the Ontology or the hierarchical structure of concepts; b) the Cognicon, where procedural information is kept; and c) the Onomasticon, where information about instances of entities and events is stored. This division of labor between linguistic knowledge in the lexical and grammatical levels and non-linguistic knowledge in the conceptual level conditions the way selectional preferences and collocations are treated in FunGramKB. Since the lexical level accounts for morphosyntactic, constructional and pragmatic lexical knowledge, collocations, but not selectional preferences, belong in here. Let us explain this in detail.

Since its first occurrence in Firth, the term collocation has been discussed extensively in the bibliography and under various names too: *co-occurrences* (Harris), *lexical solidarities* (Coseriu), *lexical selection* (Bosque “Más allá”), and so on.³ In FunGramKB, however, collocations are understood in a broad sense to

refer to those combinations of lexemes that commonly and frequently co-occur in a language, including both grammatical and lexical collocations. Thus, the fact that in English something depends *on* something else, but in Spanish it depends *de* – “of” – or that one *takes* a size five in shoes in English but in Spanish the verb used is *calzar*, find their way into the various lexica of FunGramKB, depending on the language the collocations are associated with.

As for selection restrictions, unlike the restrictive treatment given by Generative Grammar, they are understood not as semantic requirements on the nature of the arguments a predicate subcategorizes for, but as conceptual constraints prototypically related to cognitive situations. They are not word-oriented, so their place in FunGramKB is the conceptual level, specifically, the Ontology. For instance, let us take the concept EAT. Among the 350 events or so stored in the Ontology, which presents the hierarchical catalogue of all the concepts a person has in mind when talking about everyday situations, the first participant of the concept EAT is codified as being prototypically human or animal, whether you are using English, Spanish or Japanese to express it. The reason for this is that our commonsense knowledge tells us that, if we want to be consistent with our world model, in order to eat you need a mouth, which is something that only animals and people have. Therefore, traditional selection restrictions are better known as *selectional preferences* in FunGramKB. In the next section, we detail where selectional preferences appear and how they are described in the Ontology within POSSESSION.

It should be emphasized that the approach FunGramKB takes on selectional preferences as belonging in the conceptual level of information is totally

consistent with the view, sustained by most linguists – Coseriu, McCawley, Fillmore, Bosque (“Combinatoria”), to name just a few - that selection restrictions provide non-linguistic information, since the information expressed through features like *human*, *animal*, and so forth, has no relation whatsoever with our knowledge of languages like English, Spanish or Japanese, but with “the real world” and our experiences there.

3. FunGramKB Selectional Preferences: The Domain of POSSESSION

Selectional preferences appear in the Ontology in two conceptual schemata known as thematic frames (henceforth TFs) and meaning postulates (hereafter MPs). They will be exemplified in the dimension of POSSESSION which, according to Faber and Mairal (264) is:

an artificial relationship established between two entities, one of whom has the right or authority to use the other as he wishes and has the right or authority to control anyone else’s use of the other, and to impose sanctions for uses other than those he permits.

(Jackendoff 79)

In the figure below, we can see the domain of POSSESSION in the Ontology as hierarchically connected to RELATIONAL > STATIVE > EVENTS:



Fig. 2. POSSESSION in the FunGramKB Ontology.

As explained in Periñán and Mairal (“Bringing” 267), TFs and MPs provide the semantic properties used to characterize the basic and terminal concepts that populate the Ontology.⁴ The former, which appear headed by symbol +, are explained in 3.1, whereas the latter, preceded by symbol \$, are presented in 3.2.

At this stage, it is worth highlighting the importance of basic concepts, terminal concepts and subconcepts for a fine-grained knowledge base such as FunGramKB, based on deep semantics. As posited in Periñán and Arcas (“Cognitive Modules”), the FunGramKB MPs offer rich conceptual descriptions with which lexical units are then associated, that is, each lexical unit is provided with a real definition formalized employing what has been termed Conceptual Representation Language or COREL (Periñán and Mairal, “Bringing”, “La gramática de COREL”). On the contrary, other knowledge bases grounded on surface semantics, such as DOLCE (Gangemi *et al.*; Masolo *et al.*), SIMPLE (Pedersen and Keson; Lenci *et al.*), and Mikrokosmos (Beale, Nirenburg and

Mahesh; Nirenburg *et al.*), describe the conceptual content of lexical units relationally, i.e. via associations with other units in the lexicon, which restricts its expressive power and amounts to redundancy (cf. Velardi, Pazienza, and Fasolo). Therefore, all the detailed specifications done by knowledge engineers on the MPs and TFs that bring about terminal concepts and subconcepts can only but contribute to the fine-grained granularity of the FunGramKB Ontology, as opposed to other NLP systems.

3.1. Selectional preferences in basic concepts

One must bear in mind that both TFs and MPs employ concepts to formally describe meaning. Consequently, they are language-independent conceptual schemata, not lexical representations. Example (1) shows the TF and MP of the basic concept +WEAR_00, to which lexical units like English *wear, have on, dress* or Spanish *llevar, llevar puesto, traer*, and so forth are linked:

(1) +WEAR_00:

TF: (x1: +HUMAN_00 ^ +PET_00)Theme (x2: +CLOTHING_00 ^
+ORNAMENT_00)Referent

MP: +(e1: +HAVE_00 (x1)Theme (x2)Referent (f1:
+BODY_AREA_00)Location (f2: +ON_00)Position)

The TF and MP above specify the number and type of participants involved in the prototypical cognitive situation of *wearing something*, as well as the generic features associated with the conceptual meaning of this concept, which are expressed in the MP in the form of one or more logically connected predications ($e_1, e_2... e_n$) (cf. Perrián and Arcas, "Meaning Postulates" 39). Since every

participant in the TF must be referenced through co-indexation to a participant in the MP of that concept, (1) has the following interpretation: a typically human entity or pet (x1 = Theme) has clothes or ornaments (x2 = Referent) located on his/her body (Location). The selectional preferences of +WEAR_00 are then the basic concepts +HUMAN_00, +PET_00, +CLOTHING_00, +ORNAMENT_00, +BODY_AREA_00 and +ON_00. They are situated in the TFs and MPs of the Ontology because it is there that they can exert constraints typically related to the cognitive situation displayed by the events. If we come to think about the event of wearing something, we all know that human beings and pets are the ones that can prototypically have ribbons, clothes, shoes, jewelry, and so forth. Therefore, through the selectional preferences +HUMAN_00, +PET_00, +CLOTHING_00, +ORNAMENT_00, we are going beyond linguistic knowledge to try and capture our world model. Figure 3 shows how this information is displayed in the Ontology:

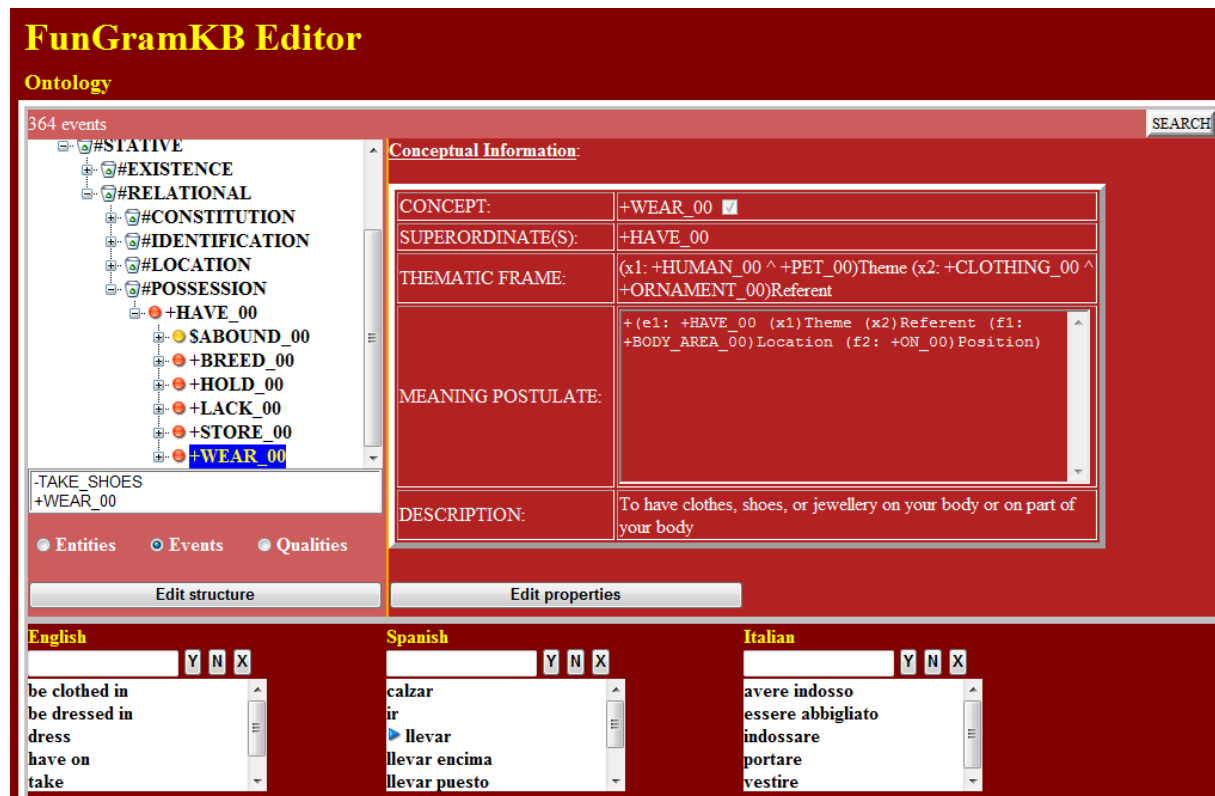


Fig. 3. Ontological information of +WEAR_00.

Examples (2), (3) and (4) illustrate the selectional preferences for the basic concepts HAVE, HOLD and STORE:

(2) +HAVE_00

TF: (x1:+HUMAN_00^+ANIMAL_00)Theme

(x2:+CORPUSCULAR_00^+HUMAN_00^+ANIMAL_00^+SUBSTANCE_00

^+ORGANIZATION_00)Referent

(3) +HOLD_00

TF: (x1: +HUMAN_00)Theme (x2: +CORPUSCULAR_00)Referent

MP: +(e1: +HAVE_00 (x1)Theme (x2)Referent (f1: +HAND_00 |

+ARM_00)Location)

(4) +STORE_00

TF: (x1: +HUMAN_00 ^ +ANIMAL_00 ^ +ORGANIZATION_00)Theme (x2: +ARTEFACT_00 ^ +CORPUSCULAR_00 ^ +SUBSTANCE_00)Referent

MP: +(e1: +HAVE_00 (x1)Theme (x2)Referent (f1)Location (f2: +LONG_01)Duration)

As for the concept +HAVE_00, its representation of (2) only includes the TF. There is no MP because it is an undefinable or semantic primitive and no other concepts can be used to provide its conceptual meaning. Thus, its TF describes a prototypical cognitive scenario in which entity 1 (Theme), being typically human or animal (+HUMAN_00, +ANIMAL_00), has or possesses another entity 2 (Referent), which is typically a three dimensional countable object, or a human, or an animal, or a type of substance, or a company, which the basic concepts +CORPUSCULAR_00, +HUMAN_00, +ANIMAL_00, +SUBSTANCE_00, and +ORGANIZATION_00 codify and the exclusion logical connector “^” links.

The concepts +HOLD_00 and +STORE_00, on the other hand, do have a TF and a MP. The basic concept +HOLD_00 has the following conceptual definition: a typically human entity (x1 = Theme) has another entity (x2 = Referent) located in his arms and/or hands (cf. the preferences +HAND_00 and +ARM_00, linked with the disjunction logical connector “|”), being this second entity prototypically a three dimensional or corpuscular object (+CORPUSCULAR_00). The representation of +STORE_00 details that a human or an animal or an organization (x1 = Theme) can typically have man-made objects or corpuscular

objects or substances (x2 = Referent) kept somewhere (f1 = Location) and for a long time (f2 = Duration).

3.2. Selectional preferences in terminal concepts

Selectional preferences are also valuable when creating terminal concepts in the FunGramKB Ontology. Since a terminal concept can only be encoded when there is a conceptual constraint on the meaning of a basic concept (Mairal and Periñán “The Anatomy” 223-24), selectional preferences allow us to codify the distinguishing parameters that differentiate them. Let us have a look at the representation of the terminal concepts \$ABOUND_00, \$GRASP_00, \$SPORT_00 and \$REGISTER_00, which are a further specification of the basic concepts +HAVE_00, +HOLD_00, +WEAR_00, and +STORE_00, respectively:

(5) \$ABOUND_00

TF: (x1: +HUMAN_00 ^ +ANIMAL_00)Theme (x2: +CORPUSCULAR_00 ^ +ANIMAL_00 ^ +SUBSTANCE_00 ^ +ORGANIZATION_00)Referent

MP: +(e1: +HAVE_00 (x1)Theme (x2)Referent (f1: +MUCH_00)Quantity)

(6) \$GRASP_00

TF: (x1: +HUMAN_00)Theme (x2: +CORPUSCULAR_00)Referent

MP: +(e1: +HOLD_00 (x1)Theme (x2)Referent (f1: +TIGHT_00)Manner)

(7) \$SPORT_00

TF: (x1: +HUMAN_00)Theme (x2: +CLOTHING_00 ^ +HAIR_01 ^ +ORNAMENT_00)Referent

MP: +(e1: +WEAR_00 (x1)Theme (x2)Referent (f1: (e2: +SHOW_00 (x1)Theme (x2)Referent (f2: +PROUD_00)Manner)) Purpose)

(8) \$REGISTER_00

TF: (x1: +HUMAN_00)Theme (x2: +INFORMATION_OBJECT_00)Referent

MP: +(e1: +STORE_00 (x1)Theme (x2)Referent (f1: +ARTEFACT_00)Instrument (f2:(e2: fut +PERCEIVE_00 (x1)Theme (x2)Referent))Purpose)

If compared with the representation of +HAVE_00 in (2), the terminal concept \$ABOUND_00 specifies that what is had (x2 = Referent) happens to occur in large numbers. This is accurately codified in the MP of \$ABOUND_00 by means of the inclusion of the selectional preference +MUCH_00, which exerts a conceptual constraint on the f1 or the QUANTITY adverbial/satellite. Notice that this concept is lexicalized in English and Spanish with verbs such as *abound*, *be rich in*, *abundar* and *rebosar*.

\$GRASP_00, to which lexical units like English *carry*, *bear*, *grasp*, *clasp*, *clutch*, *grip*, *hold on* or *wield*, and Spanish *aferrar*, *agarrar*, *asir* or *empuñar* are linked, narrows down the content of +HOLD_00 – see representation (3) - in the sense that this event is now performed firmly, tightly. By employing the basic concept +TIGHT_00 as a selectional preference in the Manner satellite f1, we can easily record this.

Furthermore, when one wears something very proudly so that everybody can see it, which in English is expressed by the verb *sport* and in Spanish by *lucir* and *ostentar*, the terminal concept \$SPORT_00 arises. This further elaboration of the

basic concept +WEAR_00 is accounted for firstly by restricting the first participant to only human beings (x1: +HUMAN_00) but expanding the second participant to also hairdos (x2: +HAIR_01),⁵ and secondly, by including the parameter purpose (f1), which itself includes a manner parameter (f2) with the selectional preference +PROUD_00. Notice that the selectional preference in f1 is not a basic concept but another predication or “e2” with its own participants: +SHOW_00 (x1)Theme (x2)Referent.

\$REGISTER_00 provides us with another instance of a predication functioning as a selectional preference: f2 = (e2: fut +PERCEIVE_00 (x1)Theme (x2)Referent))Purpose. This terminal, lexicalized as *record*, *register* (English), *grabar* and *registrar* (Spanish), is brought about when the first participant in the TF of +STORE_00 (cf. (4)) is limited to humans, whereas the second one makes reference to data, texts, and so forth, codified via the concept +INFORMATION_OBJECT_00. The MP, on the other hand, incorporates two satellites: the instrument employed (f1) and the purpose of the “registering” scenario (f2). In the former, the selectional preference +ARTEFACT_00 expresses that tape recorders, computers, and so forth, are typically used to register information, while the latter specifies that this is carried out so that the recorded information (x2 = Referent) can still be seen (+PERCEIVE_00) in the future (marked with the tense operator *fut*). Thus, selectional preferences can be expressed through predications or through one or more basic concepts, with the proviso that concepts must necessarily be entities or qualities.⁶ Below is the representation of these four terminal concepts in the Ontology, preceded by a yellow bullet and the \$ symbol:



Fig. 4. The terminal concepts ABOUT, GRASP, REGISTER, and SPORT in the Ontology.

3.3. Subconcepts

It is also worth mentioning that there are cases in which the conceptual narrowing or specification takes place exclusively inside the TF of a basic or terminal concept, without varying the MP. These are known as *subconcepts* in FunGramKB and appear preceded by a minus symbol and in capital letters. Within the domain of POSSESSION, we have been able to identify the following ones:

(9)

- a. -WIELD: a conceptual specification of the terminal concept \$GRASP_00 (cf. (6)) and lexicalized as *wield*, *carry*, *bear* and *empuñar*.
- b. -MISPLACE: linked to the basic concept +LOSE_00 and lexicalized in Spanish as *traspapelar* (lit. “misplace a paper”).

c. -SAVE: associated with the basic concept +STORE_00 (cf. (4)), which English and Spanish express as *save* and *ahorrar*.

d. -TAKE_SHOES: a specification of the basic concept +WEAR_00 (check (1)) and expressed in Spanish with the verb *calzar* (“wear shoes or boots”).

All the above subconcepts are not really visible in the Ontology, unlike basic concepts and terminal concepts – cf. Figures 3 and 4 -. In other words, they do not *hang* in the hierarchical organization of concepts because they are conceptual specifications of one of the participants of an already existing concept. For instance, -WIELD arises because the selectional preferences for the second participant in the TF of \$GRASP_00 are weapons only, unlike the corpuscular objects specified for \$GRASP_00 in (6). Notice, however, that both share the same MP.

As illustrated in (10), in the case of -MISPLACE the first participant is exclusively restricted to humans and the second one to paper. This clearly narrows down the selectional preferences of the Theme and Referent entities in the TF of +LOSE_00, which could also include animals for the first participant and only corpuscular objects for the second one – cf. representation (11) below -. Both share the same conceptual meaning or MP, namely, an entity does not have another entity because s/he put it somewhere s/he cannot remember.

(10) -MISPLACE

TF: (x1: +HUMAN_00)Theme (x2: +PAPER_00)Referent

(11) +LOSE_00

TF: (x1: +HUMAN_00^+ANIMAL_00)Theme (x2:
+CORPUSCULAR_00)Referent

MP: +(e1: +LACK_00 (x1)Theme (x2)Referent (f1: (e2: past +PUT_00
(x1)Agent (x2)Theme (x3)Origin (x4)Goal))Reason (f2: (e3: n
+REMEMBER_00 (x1)Agent (x1)Theme (x4)Referent))Reason)

As far as –SAVE is concerned, it is also the selectional preferences of the two participants of +STORE_00 that are specified. If compared to its TF in (4), the first participant of –SAVE does not include animals, whereas the second one is only money:

(12) –SAVE

TF: (x1: +HUMAN_00 ^ +ORGANIZATION_00)Theme (x2:
+MONEY_00)Referent

Finally, when the selectional preferences of the Theme and Referent entities of the basic concept +WEAR_00 are restricted to people and shoes, boots, and so forth, respectively, we come up with the subconcept –TAKE_SHOES:

(13) –TAKE_SHOES

TF: (x1: +HUMAN_00)Theme (x2: +SHOE_00)Referent

3.4. The elaboration of selectional preferences

But the immediate question now is: how have we been able to work through the selectional preferences commented above? For this purpose, we have greatly benefited from monolingual, bilingual, multilingual dictionaries,

lexicons, thesauri and corpora available in the market. Among others, we can mention:

(14) English data: *Longman Dictionary of Contemporary English*, *English Collins Dictionary and Thesaurus*, *Cambridge Advanced Learner's Dictionary*, *Merriam-Webster Dictionary*, *Multiwordnet*, *WordReference*, *Woxicon*, BBI, LTP, OCD, The Corpus Concordance and Collocation Sampler from *The Collins Wordbanks Online English Corpus*, *British National Corpus (BNC)*, *Corpus of Contemporary American English (COCA)*.

(15) Spanish data: MARÍA MOLINER, CASARES, CLAVE, REDES, ADESSE: *Alternancias de Diátesis y Esquemas Sintáctico-Semánticos del Español*, CREA: *Corpus de Referencia del Español Actual*, DRAE: *Diccionario de la Lengua Española*, *Corpus del Español* (Mark Davies).

One word is needed here for the exhaustive and precise work on selection restrictions carried out by Ignacio Bosque in *REDES*. It has been really useful for our purposes, since it is one of the first Spanish dictionaries exclusively devoted to these issues, which, unlike the English collocation dictionaries, takes as starting point the semantic relation between a predicate and its argument(s) and the notion of lexical class. However, as there are not yet dictionaries that provide us with conceptual definitions, preferences, TFs, and so forth, we have had to basically follow this step-by-step process:

(i) look up every single word belonging in the scenario we are working on in the English and Spanish resources mentioned in (14) and (15). As a way of exemplification, let us employ the terminal concept \$SPORT_00

in (7),⁷ which, as commented above, is lexicalized in English and Spanish as *sport/lucir* and *ostentar*,

- (ii) note down meticulously all the lexical information given for their selection restrictions, collocations, words that typically occur as subjects or objects, examples, and so forth. Below is some of the information the resources consulted provide us for *sport/lucir* and *ostentar*.

(16) *sport*:

a. *Longman*: be sporting something, to be wearing something or have something on your body and show it to people in a proud way: *Eric was sporting a new camel-hair coat*.

b. *Cambridge*: to wear or be decorated with something: *He sported bell-bottom trousers*.

c. *Merriam-Webster*: to display or wear usually ostentatiously: *sporting expensive new shoes*.

d. *COCA*: list of the most frequent collocates:⁸

Table 1. Collocates of *sport*.

Subject	Object
MODELS	TATTOOS
MEN	SEAMS

BUILDINGS	PADS
STORES	T-SHIRTS
BRANCHES	EYEBROWS
VEHICLES	BOOTS
SHARES	PAIR
ROOMS	NAMES
SHOP	UPPERS
WALLS	HEADDRESSES
LEAVES	BULGES
PLANTS	HAIRSTYLE
FLOWERS	BEARDS
	SKIRTS
	JACKETS
	HATS
	SHIRTS
	SCREENS
	JEWELRY

	SHAPES
	SUITS
	BAGS
	POCKET
	APPEARANCE
	UNITS
	COLORS

(17) *lucir/ sport*:

a. *Moliner*: tr. *Exhibir una ÷cosa de que se está satisfecho u orgulloso.

("to show something which you are proud of")

b. *Clave*: Exhibir o mostrar presumiendo: *Va a las fiestas para lucir las joyas. Le gusta lucirse ante las personas que todavía no lo conocen.* ("to exhibit showing off: *She/He goes to parties to show off her/his jewellery. She/He likes showing off in front of people who do not know him/her yet*")

c. *DRAE*: Llevar a la vista, exhibir lo que alguien se ha puesto, normalmente como adorno. ("to wear, display something you are wearing, usu. as an ornament")

d. *ADESSE*: list of the most frequent collocates:

Table 2. Collocates of *lucir*.

Subject	Object
EXTRANJEROS/FOREIGNERS	PEINADO/HAIRDO
POBLACIÓN/POPULATION	VESTIDO/DRESS
JÓVENES/YOUNGSTERS	PELO/HAIR
JOVEN/YOUNGSTER	CABELLO/HAIR
CHICA/GIRL	PANCARTAS/BANNERS
VERÓNICA LAKE	CADENA/NECKLACE
AMBAS/BOTH	MARGARITAS/DAISIES
	TRAJE/SUIT
	ABRIGO/COAT
	COLMILLOS/CANINE TEETH
	ALHAJAS/JEWELRY
	EMBLEMAS/EMBLEM
	FRAC/TAIL COAT
	FLORES/FLOWERS
	ESTAMPA/DESIGN
	PELAMBRE/BODYHAIR
	SELLO/STAMP
	HABILIDADES/ABILITIES

(18) *ostentar/ sport*

a. *Moliner*: tr. Hacer, con satisfacción, orgullo o jactancia, que cierta ÷cosa propia sea vista o conocida por los demás: ‘Ostenta su belleza [sus títulos, sus joyas, su amistad con el ministro]’. (“To display proudly so that it can be seen: she/he sports titles, beauty, jewels, her/his friendship with the minister”)

b. *Clave: 1* Exhibir con orgullo, vanidad o presunción: *El capitán del equipo ostentaba el trofeo delante de los periodistas*. (“to display proudly, ostentatiously or pretentiously: *The team captain sported the trophy in front of the journalists*”)

2 Mostrar o llevar de forma visible: *Los jugadores ostentaban un brazalete negro en señal de duelo por su antiguo entrenador*. (“To show or wear in a visible way: *The players sported black armbands in mourning for their late coach*”)

c. *DRAE: 1.* tr. Mostrar o hacer patente algo. (“to show or make something visible”)

d. *ADESSE*: list of the most frequent collocates:

Table 3. Collocates of *ostentar*.

Subject	Object
MUCHACHA/GIRL	CONDICIÓN/POSITION
INDIVIDUOS/INDIVIDUALS	CARTERA/PORTFOLIO
BRUNETTINO	MANDO/COMMAND

ESPAÑOLAS/SPANISH WOMEN	APARIENCIA/APPEARANCE
CULTURA/CULTURE	RASGOS/FEATURES
ACUERDOS/AGREEMENTS	GUSTO/TASTE
	ESCUDOS/BADGES
	MEDALLA/MEDAL
	CHAPITA/BADGE

(iii) look for general labels or "umbrella" patterns that could work for every word linked to a particular concept and in every language we are working with. One cannot forget that, although taking lexical information as point of departure, our purpose is to list selectional preferences, that is, conceptual narrowing. Therefore, we must really abstract away from specific words and come up with the participants our commonsense knowledge would identify as being prototypically part of cognitive scenarios such as "having something", "losing something", and so on. For example, in the typical scenario of "sporting something", the common collocates of the words that lexicalize this concept could be generalized as:

(19) first participant: people.⁹

(20) second participant: clothes, shoes, hairdos, jewelry, bags, looks, badges, tattoos.

- (iv) find the appropriate basic concepts to codify the abstract labels among the 1,300 concepts available in the FunGramKB Ontology: +HUMAN_00, +GARMENT_00, and so on.¹⁰ Such move is laboriously carried out by looking up in the Ontology each of the typical participants identified in (19) and (20) so that we are able to reach the basic concept to which these words are linked. As stated in Perrián and Arcas (“Ontological Commitments” 32-33), the FunGramKB Ontology allows multiple inheritance, that is to say, a conceptual unit can be subsumed by two or more concepts, creating complex hierarchies. This is shown in the first predication of the MP of concepts, which always includes all the superordinate concepts of the *definiendum*, together with one and only one logical relation (&, | or ^) between the multiple parents. In this way, this first predication of the MP explicitly states the conceptual route that determines the IS-A path to its root. Consequently, in order to identify the basic concepts that codify selectional preferences, we traced the conceptual route taken by a particular concept to which specific words may be linked. For instance, if we search the lexical unit *shoe* in the Ontology, we will find the following MP and conceptual route:

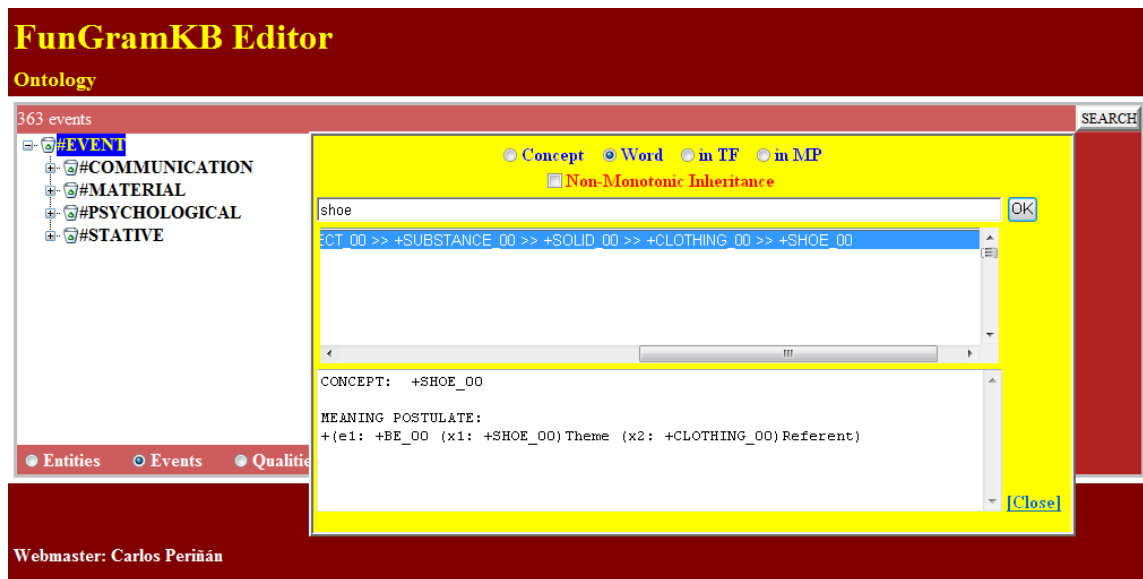


Fig. 5. Conceptual route of *shoe*.

Since the word *clothes* is also traced down and linked to the basic concept +CLOTHING_00, this is the concept chosen to express both of them as selectional preferences in the TF of +SPORT_00. Likewise, the rest of the lexical units of (20) have been conceptually tracked down, resulting in the following selectional preferences, repeated below for convenience as (21):

(21) \$SPORT_00

TF: (x1: +HUMAN_00)Theme (x2: +CLOTHING_00 ^ +HAIR_01 ^ +ORNAMENT_00)Referent

After this account of selectional preferences, there is yet a last issue that needs to be addressed, that is, the place of collocations in FunGramKB. As pointed out in section 2, collocations are word-oriented so they are stored in their appropriate lexica, depending on the language the word is associated with. For instance, let us

take the Spanish word *atesorar/hoard* or *accumulate*, which is one of the words that lexicalizes the concept +STORE_00 in (4), as illustrated below:

The screenshot shows the FunGramKB Editor interface. On the left, there is a tree view of the ontology with categories like #RELATIONAL, #CONSTITUTION, #IDENTIFICATION, #LOCATION, #POSSESSION, and #HAVE_00. The concept +STORE_00 is highlighted. Below the tree, there are buttons for -SAVE, +STORE_00, and radio buttons for Entities, Events, and Qualities. The main panel displays the following information:

CONCEPT:	+STORE_00
SUPERORDINATE(S):	+HAVE_00
THEMATIC FRAME:	(x1: +HUMAN_00 ^ +ANIMAL_00 ^ +ORGANIZATION_00)Theme (x2: +ARTEFACT_00 ^ +CORPUSCULAR_00 ^ +SUBSTANCE_00)Referent
MEANING POSTULATE:	+(e1: +HAVE_00 (x1)Theme (x2)Referent (f1) Location (f2: +LONG_01)Duration)
DESCRIPTION:	provide storage for or keep in storage

At the bottom, there are three panels for lexical units in English, Spanish, and Italian. The English panel lists: accumulate, bond, garner, hoard, hold. The Spanish panel lists: acumular, ahorrar, almacenar, atesorar, conservar. The Italian panel lists: accaparrare, accumulare, conservare, depositare, detenere.

Fig. 6. English, Spanish and Italian lexical units linked to the concept +STORE_00.

According to *REDES*, *atesorar* frequently occurs with the following words: *victoria/victory*, *éxito/success*, *información/information*, *secreto/secret*, and *recuerdo/memories*. Therefore, FunGramKB inserts all these collocates in the Spanish lexicon as part of the morphosyntactic and pragmatic information linked to this word. To be more specific, these collocates appear in the LCM core grammar block of the Spanish lexicon, in the “collocations” slot for the second argument (y) of *atesorar*, as can be seen below:

LCM CORE GRAMMAR:

AktionsArt:

State
 Activity
 Accomplishment
 Achievement

You determine the canonical lexical class(es) of the verb.

Lexical Template:

Variables: <- no functions ->

Idiosyncratic features:

[MR <- no value selected -> <- no value selected ->

Thematic frame mapping:

X = [no function] [no function] [no function]

A REMINDER OF FUNGRAMKB PARTICIPANTS:
 THEME: Entity that owns another entity.
 REFERENT: Entity that is owned.

Prepositions:

X = a Y N Y = a Y N Z = a Y N

Collocations:

X = Y = Z =

éxito
 información
 recuerdo
 secreto
 victoria

Fig. 7. Collocations of *atesorar/hoard* in the FunGramKB Spanish lexicon.

On the other hand, its English equivalent *hoard*, according to the *Collins Corpus Concordance and Collocation Sampler* consulted, typically collocates with words such as *flaw*, *time*, *misery*, *nostalgia* and *information*. Accordingly, as displayed below, these collocations appear in the English lexicon, specifically in the “collocations” slot for the second argument (y) of *hoard*:

LCM CORE GRAMMAR:

AktionsArt:

- Accomplishment
- Achievement
- Semelfactive
- Active accomplishment
- Causative state

You determine the canonical lexical class(es) of the verb.

Lexical Template:

Variables: <- no functions -->

Idiosyncratic features:

[MR] <- no value selected --> <- no value selected -->

Thematic frame mapping:

X = [no function] [no function] [no function]

A REMINDER OF FUNGRAMKB PARTICIPANTS:
 THEME: Entity that owns another entity.
 REFERENT: Entity that is owned.

Prepositions:

X = aboard Y N Y = aboard Y N Z = aboard Y N

Collocations:

X = Y N Y = Y N Z = Y N

flaw
 information
 misery
 nostalgia
 time

Fig. 8. Collocations of *hoard* in the FunGramKB English lexicon.

The lexico-conceptual nature of FunGramKB accounted for in these pages, that is, the lexical, grammatical and conceptual levels of information, allows a direct linkage between the grammatically salient lexical information of the RRG logical structures included in the different lexica – *Aktionsart* class, macrorol, and so forth, in Figures 7 and 8 - and the conceptual meaning of the TFs and MPs of the Ontology. As detailed in Periñán and Mairal (“Bringing” 269-70), such a gap is bridged through an abstract representational mechanism known as *conceptual logical structure* (hereafter CLS). In fact, there is available a CLS Constructor that can automatically

build CLSs from the RRG representations stored in the LCM Core Grammar block. To illustrate, the Constructor, among other things, would match each variable in the lexical template of the word under consideration (e.g. *hoard*) with one participant in the TF of the concept that lexical item is linked to, that is, +STORE_00 in Figure 6. We will leave for further research the inner workings of the CLS Constructor.

4. Conclusion

This paper has put forth how selection restrictions and collocations can be accounted for by the FunGramKB's conceptualist view on language. Among others, here are some of the advantages of such approach for RRG:

- (i) by posing three information levels, that is, the Ontology, the Grammaticon, and the different Lexica, RRG semantic representations can be deeply enriched, including all types of information that go well beyond those aspects of meaning with an impact on syntax (e.g. selection restrictions) by linking these RRG structures to the conceptual meaning structures of the Ontology;
- (ii) this theoretical move is done at a very low cost, because the Ontology is based on a hierarchical inference system, which means that information can be placed in and retrieved from all the different ontological properties: TFs, MPs, subconcepts, and so forth. Thus, “redundancy is minimized while informativeness is maximized” (Periñán and Mairal, “Bringing” 269);
- (iii) since ontological concepts are universal, in principle every single language could be implemented in FunGramKB.

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¹ FunGramKB was born as a user-friendly online lexico-conceptual natural language processing system that sought to develop a conceptual approach based on deep semantics. Drawing from previous work by Periñán and Arcas (“Meaning Postulates”, “Microconceptual-Knowledge”, “Cognitive Modules”), this knowledge-base system has fused with the comprehensive theory of meaning, grounded on the RRG framework, known as the Lexical Constructional Model (hereafter LCM; Mairal and Ruiz de Mendoza, “New Challenges”, “Levels”; Ruiz de Mendoza and Mairal, among others) in an attempt to build an updated and robust FunGramKB that benefits from the best of both worlds, that is, a lexico-conceptual knowledge base with rich semantic and syntactic information. For further information on FunGramKB and the LCM, we refer the reader to the Lexicom group research webpage: www.lexicom.es.

² Although so far English and Spanish are fully supported in the current version of FunGramKB, in the near future other languages such as Italian, German, French, Bulgarian and Catalan will also be contemplated (cf. Periñán and Mairal, “The Anatomy” 266).

³ The interested reader can find a thorough review of the main authors that have studied this topic in Koike. Among others, one can mention the studies on English, German and French collocations by Halliday (“Categories”, “Lexis”), Sinclair, Coseriu, Mitchell, Mel’cuk or Cruse, as well as the accounts of Spanish collocations by Mendívil, Alonso Ramos, Corpas, and Wotjak.

⁴ The FunGramKB Ontology distinguishes three different conceptual levels, each one with concepts of a different type (Periñán and Arcas, “Meaning Postulates”): (a) Metaconcepts (e.g. #ABSTRACT, #PSYCHOLOGICAL, #POSSESSION, etc.), which form the upper level in the taxonomy and, as Periñán and Arcas (“Reusing” 72) point out, can be regarded as “hidden categories”, that is, concepts that, since they are not associated with specific lexical units, can be employed as hidden superordinates and avoid circularity; (b) Basic concepts, preceded by symbol +, which are used as defining units that enable the construction of MPs for basic concepts and terminals, as well as taking part as selectional preferences in TFs: for example, +HUMAN_00, +ON_00, or +BE_00; (c) Terminal concepts, which are headed by symbol \$ but are neither hierarchically structured nor have definitory potential to take part in MPs: for example \$GRASP_00, \$SPORT_00, \$SUBTITLE_00.

⁵ In the syntax of COREL, whenever we have a concept displaying more than one meaning, and thus associated with different conceptual scenarios, numbers 00, 01, 02 are simply employed to differentiate them. In this particular case, +HAIR_00 is identified with the hair that grows on people’s and animals’ bodies, whereas +HAIR_01 is associated with hairdos and everything related to the hair that grows on the head.

⁶ Although this paper deals only with events, the FunGramKB Ontology is actually split into three subontologies, since subsumption (IS-A) is the only taxonomic relation permitted. Therefore, each subontology arranges lexical units of a different part of speech: #ENTITIES for nouns (e.g. +BIRD_00, +SOUL_00, +FREEDOM_00...), #EVENTS for verbs (+WEAR_00, +TRANSLATE_00, etc.), and #QUALITIES for adjectives and some adverbs (i.e. +HAPPY_00, +ALONE_00...). In Periñán and Mairal (“La gramática de COREL” 20) it is made explicit that qualities can only function as selectional preferences of participants that have the thematic roles Attribute, Frequency, Position or Speed.

⁷ Jiménez and Luzondo detail the laborious process carried out by knowledge engineers to elaborate the different types of concepts that populate the FunGramKB Ontology, particularly, terminal concepts.

That methodology has also been employed in this paper in the creation of the terminals and subconcepts associated with the metaconcept POSSESSION.

⁸ Since the COCA list of collocates includes the four words that appear both to the left and to the right of the search, a process of discarding adjectives, adverbs, other senses of the search, and so forth, as well as sorting out which words were functioning as subject and which ones as object, has necessarily been applied manually.

⁹ Even though words such as *vehicles*, *rooms*, *stores*, *culture*, *leaves*, and so on can also occur as first participants of these verbal predicates, it is worth stressing that a nuclear Ontology like the one developed by FunGramKB aims to gather those concepts possessed by an average cultivated speaker, which excludes the metaphorical and metonymic uses speakers may freely employ.

¹⁰ As commented in Mairal and Perrián ("The Anatomy" 224), the inventory of almost 1,300 basic concepts employed in FunGramKB stems from the defining vocabulary used in the *Longman Dictionary of Contemporary English* (Procter) and in the *Diccionario para la Enseñanza de la Lengua Española* (Ezquerria).

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