The integration of a philosophical dimension in the subontology #QUALITY of FunGramKB: The case of axiological evaluation[1]

Ángel Felices-Lago [a] and Pedro Ureña Gómez-Moreno [b]

[a] Department of English & German
University of Granada
Granada, Spain
afelices@ugr.es

[b] Department of English & German
University of Granada
Granada, Spain
pedrou@ugr.es

Keywords: *ontologies, terminology, axiology, FunGramKB, Knowledge base*

Abstract

FunGramKB, on the one hand, is the result of a knowledge-engineering project for natural language understanding based on a knowledge base which has been designed to be reused in various NLP tasks (e.g. information retrieval and extraction, machine translation, dialogue-based systems, etc) and with diverse languages. It comprises three major interrelated knowledge level modules: lexical, grammatical and conceptual. At the conceptual level the Core Ontology is presented as a hierarchical catalogue of the concepts that a person has in mind. On the other hand, axiology is interpreted here as "the science of values" and its relevance to linguistic semantics. This implies that values are immanent in the semantic poles of symbolic units making up human language. This parameter can be traced back to the three subontologies in which FunGramKB can be split: #ENTITY for nouns, # EVENT for verbs, and #QUALITY for adjectives. In this paper we shall concentrate on the category # QUALITY and explore how the main categories and features of this parameter (positive-negative [+/-]) are represented and encoded within FunGramKB ontology, particularly inside semantic properties such as thematic frames and meaning postulates.

[1] This research is the continuation of the study published in this *LSP Journal*, vol.3, no.1 (2012), pp. 51-60, entitled: "The configuration of a philosophical parameter in the subontology #ENTITY of FunGramKB: The case of axiology".

1 A basic assumption

In this study we are trying to reconcile and integrate two apparently divergent epistemological entities: axiology (sections 2 and 3), on the one hand, which is widely considered to be a primitive, basic or key philosophical axis in the architecture of meaning construction at different levels and, on the other hand, the knowledge base entitled FunGramKB (section 4), which is a multipurpose lexico-conceptual knowledge base for natural language processing (NLP) systems. To clarify this potential integration (section 5), it is necessary to introduce the theoretical principles which can account for both entities in the following three sections.

2 Axiology

Personal Values provide an internal reference for what is good, beneficial, important, useful, beautiful, desirable, constructive, etc. Values generate behaviour and help solve common human problems for survival by comparative rankings of value, the results of which provide answers to questions of why people do what they do and in what order they choose to do them. In consequence, *valuation* is an inherent aspect of categorization. In fact, in the ontogenetic development of every human being, the first categorizations are valuations. The reason is that we are assessing beings. It is also assumed that the first categorization that a baby makes is evaluative in that it involves the division of all things into good and bad in the most primitive, sensory meaning of these terms. To appreciate the presence of values as well as to evaluate, we need to recognize some system of values. Valuations constitute an aspect of all categorizations, and categorizations directly manifest themselves in language (Felices-Lago 2003). This establishes a direct link between values and language. Langacker (1988: 64) distinguishes four types of perspective that are relevant to valuation: (i) orientation, (ii) vantage point, (iii) directionality, and (iv) subjectivity.

(i) The *orientations* RIGHT-LEFT, UP-DOWN, and FRONT-BACK can be metaphorically extended to valuation with the resulting difference in the axiological construal of various concepts. The SCALE schema is more or less explicitly present in every valuation as it can be understood in terms of the UP-DOWN or FRONT-BACK orientation. What makes the SCALE different is the PLUS-MINUS polarity, which is imposed on other schemata: UP/FRONT is PLUS and DOWN/BACK is MINUS.

(ii) *Vantage point* is closely connected with orientation. A particular scene may be construed positively or negatively, depending on the vantage point of the valuator. As a default-case option the speaker is the valuator.

(iii) Different construals in valuation may also be due to contrasts in *directionality*. For example, given entities of different size, one can compare them by relating the size of entity A to the size of entity B or by relating the size of entity B to the size of entity A.

(iv) *Subjectivity* is particularly relevant in all valuations. As Langacker observes, subjectivity is graded and varies on the scale from very subjective to very objective.

Consequently, axiology is considered to be a primitive, basic or key parameter, among others, in the architecture of meaning construction at different levels in language (Hare 1952; Osgood, Suci, Tannenbaum 1957; Katz, 1964; Coseriu 1967; Pottier 1974; Leech 1975; Nida 1975; Lyons 1977; Stati 1979; Krzeszowski, 1990, 1993, 1997; Felices-Lago, 1991, 1997; Cortés-de-los-Ríos, 2001, and many others).

One of the linguists mentioned above, Tomasz P. Krzeszowski (1990), takes a step further and criticizes the excessive importance attributed historically to the “true-false” polar axis to the detriment of the “good-bad” one, which, in his opinion, is the most important parameter in

linguistics. He arrived at that conclusion when, analyzing a large number of sentences and words, he found out that every lexical item is assessable on the good-bad scale. Some lexical items are situated close to the "good" pole, e.g. *love, care, grow, delight*, some are situated close to the "bad" pole, e.g. *hate, abhor, die, complain*, while others are situated at various distances from the two poles, with a considerable number of lexical items displaying no ostensible charge in plus or in minus, e.g. *appear, declare, compare, etc.*

3 The axiological axis in the adjectival lexicon: theoretical remarks

The development of structural semantics and its new terminology gave rise to a new discipline basically sketched by Eugenio Coseriu in 1968: *Classematics*.[2] This functional linguist was the first to raise the issue of an evaluation classeme affecting a large amount of adjectives:

> (…) there may be classes like "positive", "negative", which justify copulative combinations as It. "bello e buono" [*noble and handsome*], "grande e grosso" [*big and tall*], "piccolo e brutto"[*small and ugly*], etc., (adjectives which belong, in each case, to the same class), or adversative combinations as Sp. "pobre pero honrado" [*poor but honest*] It. "povero ma onesto" (adjectives which belong to different classes) (…). [Translated from Spanish] (Coseriu 1968, Spanish ed. 1977:176)

He only referred to adjectives, being obvious that this type of classeme would affect other open lexical classes, like verbs or nouns (Felices-Lago 1997, 2003).

Two decades ago, the developments of the Functional Grammar lexicon into a model which could integrate semantic, syntactic and pragmatic aspects of lexemes within a framework combining both paradigmatic and syntagmatic patterning was the pioneering contribution of Leocadio Martin Mingorance (1990, 1995) and his Functional Lexematic Model (FLM).[3] In this model**,** Martín Mingorance (1987: 380-84), inspired by Coseriu (1967, 1968), introduced the category *classemes*, which were defined as general semantic and syntactic determinations in the vocabulary or as a kind of grammar.[4] Then, he distinguished different kinds of classemes according to the pragmatic, semantic, syntactic, syntactic-semantic components, and concluded that the number and type of pragmatic classemes will depend on further research, but stylistic labels (diatopic, diaphasic, diastratic features) and such elements as "norm", "focus", "speaker's evaluation", "aesthetic norm", etc. constitute a kind of features which will condition the choice of specific lexemes according to the type of communicative situation. He offered an example of the process followed by a pragmatic classeme:

[2] In the Functional Lexematic Model (FLM) designed by Martin Mingorance (1987, 1990, 1995) Coseriu`s structural semantics theory and the principles of classematics are integrated in the Functional Grammar of Simon C. Dik to help develop the lexicon component.

[3] The origins of the FLM are deeply rooted in the early Functional Grammar approach to the lexicon offered by Simon C. Dik (1978, 1989) but also in the structural semantics theory of Eugenio Coseriu (1967).

[4] Coseriu accounted for *classematics* as a promising field of research at that time. He considered that an in-depth analysis of their structure and types could contribute to the clarification of a key process in language: the interaction between the pragmatic, the semantic, the syntactic and the lexical component.

> In the selection of a verb[5] like *gobble* in a communicative situation in which the speaker`s disapproval of someone`s way of eating constitutes the information focus, the lexical choice will be determined in the paradigmatic axis fundamentally by the pragmatic feature [NORM: SOCIALLY SET: VIOLATION], i.e. "violation of a socially set norm", which is most salient differentiating feature with regard to the other verbs in this paradigm (*gorge, guzzle, wolf, devour, bolt,* etc.). (Martín-Mingorance 1987: 384).

Both norms (axiological and social) are so close to each other that it is sometimes difficult to determine whether certain features of word meanings should be accounted as axiological or sociocultural. In consequence, sociocultural contexts such as biological/ social/ aesthetic norms often refer to values imposed by a given society. If in consumption, *gobble* encodes the violation of a socially-set aesthetic norm since the semantic parameters, *quickly* and *greedily*, are negatively evaluated with respect to our conceptualization of how people should eat, then we are saying that *gobble*, the same as *wolf* or *gorge* (consumption of large quantities of food), are verbs affected by the axiological evaluation pattern for exactly the same reasons as they are affected by the social (or sociocultural) pattern. In our opinion, this redundancy can be solved either by merging common aspects of both patterns or by creating a third one that accounts for such examples.

Faber and Mairal-Usón (1999) proposed four macro-organizational patterns which appear across a wide range of verbal domains: Space; Time; Sociocultural context and *Axiological Evaluation (positive/negative).* The first two patterns basically affect verbs, but the last two are shared by verbs, nouns or adjectives. The axiological pattern basically referred to Krzeszowski Lakoffian approach based on a three-level hierarchy of values (*sensory experience, life and health, spiritual level*) given by classical axiologists such as Max Scheler or Tischner. Faber and Mairal-Usón (1999: 242) also underlined the dominant function that *values* perform in the structure of concepts (Krzeszowski 1990; Felices-Lago 1991; Escalier-Fournier 1997) and followed Krzeszowski in his claim that most lexical items are assessable on an axiological scale and that, in general, words have a tendency to be axiologically loaded with positive or negative connotations in proportion to the degree of human factor associated with them. They also observed that the opposition *good* and *bad* consistently appears in the lexical semantic structure of English verbs. However, previous approaches to the nature of axiologically-loaded words had claimed that adjectives and adverbs, more than other words, carry a distinct axiological charge and, in this way, are more prototypically evaluative than nouns and verbs (Coseriu 1968; Stati 1979; Aarts and Calbert 1979; Krzeszowski 1990, 1997; Felices-Lago 1991). Obviously, it can be deducted that *axiological evaluation* is based on a series of axes, scales and figures that contribute to outlining the prototypical features characterizing its structure (Felices-Lago 2003: 187). The first axis (see figure 1) is preconceptual, lexicogenesic and dual, referring to its polar nature:

[5] Although Martin Mingorance takes a verb as an example, the same process can be applied to adjectives or nouns.

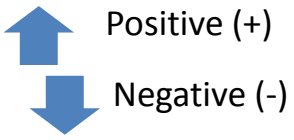

Figure 1. Polar nature of axiological evaluation

The second axis (see figure 2) is a scale which can be integrated in the previous one and refers to the varying degrees of positiveness or negativity that are essential to the units affected by the axiological pattern.

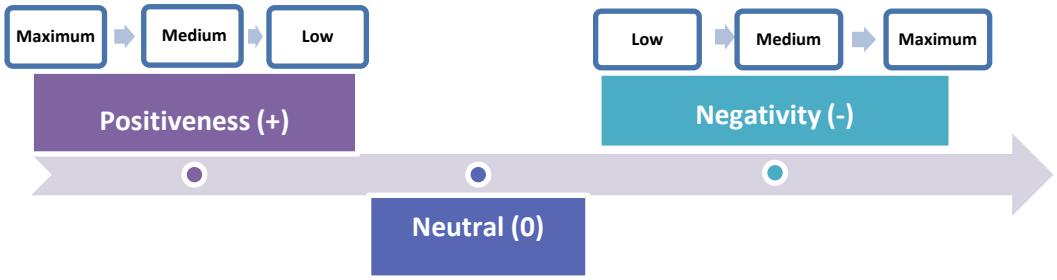

Figure 2. Axiological scale

The third axis (see figure 3) is a scale which refers to the hierarchy of axiological dimensions at linguistic level (Felices-Lago 1997: 105). This scale does not presuppose the fact that certain values are higher (or better values) than others, because that may depend on the position of each domain, subdomain or lexeme in the configuration of the adjectival lexicon. It is also related to the speaker`s individual value system or, at least, to the reliability of unbiased intersubjective sources (corpora, surveys, lexicographical definitions, etc.).[6]

Generic positiveness, 'good' encapsulates all specific positive dimensions, regardless of the existence of prototypical positive items.

Generic negativity, 'bad' encapsulates all specific negative dimensions, regardless of the existence of prototypical negative items.

[6] From a linguistic perspective, as it was claimed in Felices-Lago (2003), different axiological levels are not hierarchical according to the deterministic, religious or ideological point of view of philosophers or individuals (*i.e.* Tischner), even if their ideas are extremely well-presented. The only hierarchy that can be assumed for general purposes is built in language and depends, for its relevance (positive or negative), on what is perceived by the vast majority of speakers of a linguistic community as well as on the result of an exhaustive scrutiny of empirical data. Obviously, at a pragmatic level, the amount of potentially axiologically-sensitive units would increase dramatically depending on the speaker`s implicit illocutionary force or implicational intent.

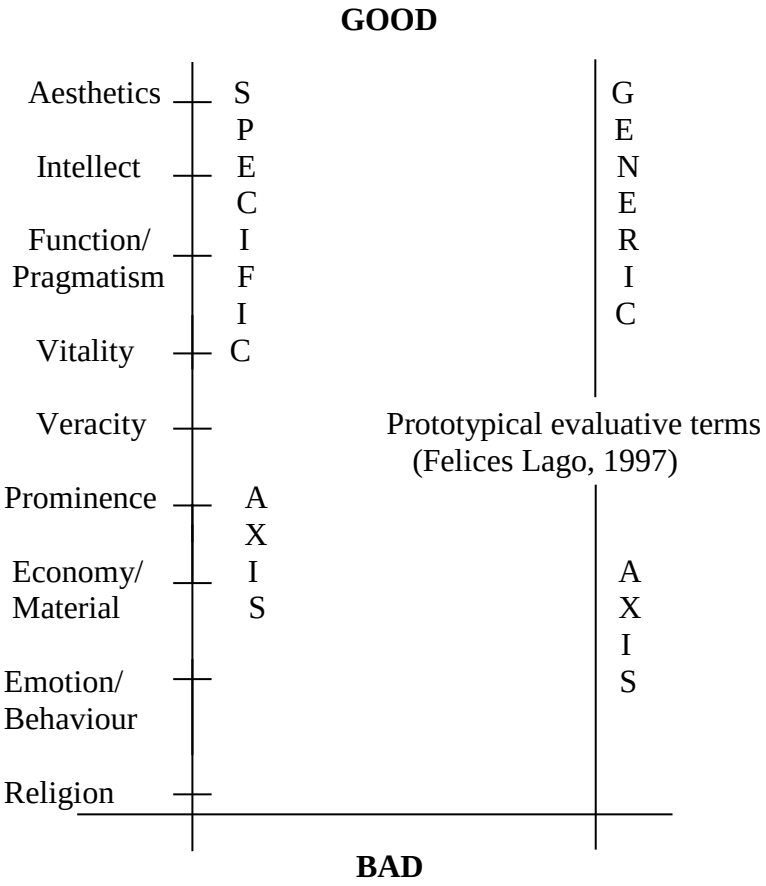

Figure 3. Hierarchy of axiological dimensions at linguistic level

As can be shown in section 5, this axiological axis (multidimensional scale) can be applied to the basic and terminal concepts included in the #QUALITY FunGramKB subontology and, consequently, extended to the adjectival lexicon units.[7]

4 FunGramKB conceptual structure

At this point, the integration of the axiological parameter in the knowledge base under construction (FunGramKB) requires at least a brief presentation of its main modules and characteristics to help the reader understand the compatibility of the integration referred to above. This project is rooted in the comprehensive theory of constructional meaning known as the Lexical Constructional Model (Mairal-Usón and Ruiz-de-Mendoza, 2008, 2009; Ruiz-de-Mendoza and Mairal-Usón, 2008, among others), which, in the last few years, has incorporated as part of its architecture *FunGramKB* (FGKB), and FunGramKB Suite, which is the combination of a user-friendly online environment for the semiautomatic construction of a multipurpose lexico-conceptual knowledge base for natural language processing (NLP)

[7] The relevance of this axis is based on the evidence provided by the axiological classifications of philosophers, psychologists and linguists throughout the 20th century. For a more detailed study, (Felices-Lago 1991: chapters 3 and 4).

systems, and more particularly for natural language understanding. On the one hand, FunGramKB is multipurpose in the sense that it is both multifunctional and multilingual. Thus, FunGramKB has been designed to be potentially reused in many NLP tasks (e.g. information retrieval and extraction, machine translation, dialogue-based systems, etc.) and with many natural languages. On the other hand, this knowledge base comprises three major knowledge levels, consisting of several independent but interrelated modules: lexical level, grammatical level and conceptual level. The conceptual level includes *the Ontology*, which is a hierarchical catalogue of the concepts that a person has in mind, so here is where semantic knowledge is stored in the form of meaning postulates.

This *Core Ontology* which is conceived as a conceptual IS-A taxonomy, allows multiple non-monotonic inheritance and distinguishes three different conceptual levels, each one of them with concepts of a different type and organized hierarchically: metaconcepts, basic concepts and terminals.

(i) Metaconcepts, preceded by the "#" symbol, constitute the upper level in the taxonomy and represent cognitive dimensions around which the rest of the conceptual units are organized. The analysis of the upper level in the main linguistic ontologies —SUMO, DOLCE, GUM, Mikrokosmos, SIMPLE etc.— led to a metaconceptual model whose design contributes to the integration and exchange of information with other ontologies, providing thus standardization and uniformity. Some metaconcepts are #ABSTRACT, #MOTION and #TEMPORAL. The result amounts to 42 metaconcepts distributed in three subontologies: #ENTITY, #EVENT and #QUALITY.

(ii) Basic concepts, preceded by the "+" symbol, constitute the intermediate level of the Ontology. These are used in FunGramKB as defining units which enable the construction of meaning postulates for basic concepts and terminals, as well as taking part as selectional preferences in thematic frames.

(iii) Terminal concepts, preceded by the "$" symbol, represent the final nodes in the conceptual hierarchy and lack definitory potential to take part in FunGramKB meaning postulates. Examples of terminal concepts are $ADAPT_00, $FLUCTUATE_00 and $SKYSCRAPER_00.

As a consequence of the the previous structure, a philosofical dimension such as *valuation* (or the axiological parameter) might be traced back to the three subontologies in which FunGramKB Core Ontology can be split: #ENTITY for nouns, #EVENT for verbs, and #QUALITY for adjectives (and some adverbs). In this paper we shall concentrate on the subontology #QUALITY and explore how the main categories and features of the axiological parameter (good-bad or positive-negative [+/-]) are represented and encoded within FunGramKB ontology. To do that, we should understand first how this ontology works on the basis of the following protocol: FunGramKB Ontology stores semantic knowledge in the form of thematic frames (TFs) and meaning postulates (MPs) by presenting a hierarchical catalogue of all the concepts (not "words", unlike FrameNet or MultiWordNet) that a person has in mind and works with two reasoning mechanisms: inheritance and inference, due to the fact that it is constructed on the basis of a deep semantic approach which not only displays concepts, but also defines them through a machine-readable metalanguage called COREL (*Conceptual Representation Language*) designed by Periñán-Pascual and Mairal-Usón (2010).

Basic and terminal concepts in FunGramKB are provided with semantic properties which are captured by *thematic frames* and *meaning postulates*. Every quality in the ontology is

assigned one single thematic frame, i.e. a conceptual construct which states the number and type of participants involved in the prototypical cognitive situation portrayed by the entity (in the case of nouns). Moreover, a meaning postulate is a set of one or more logically connected predications (e_1, e_2, … e_n), i.e. conceptual constructs that represent the generic features of concepts. As stated above, the basic concepts are the main building blocks of these types of constructs in the Core Ontology (Periñán-Pascual and Arcas-Túnez, 2007).

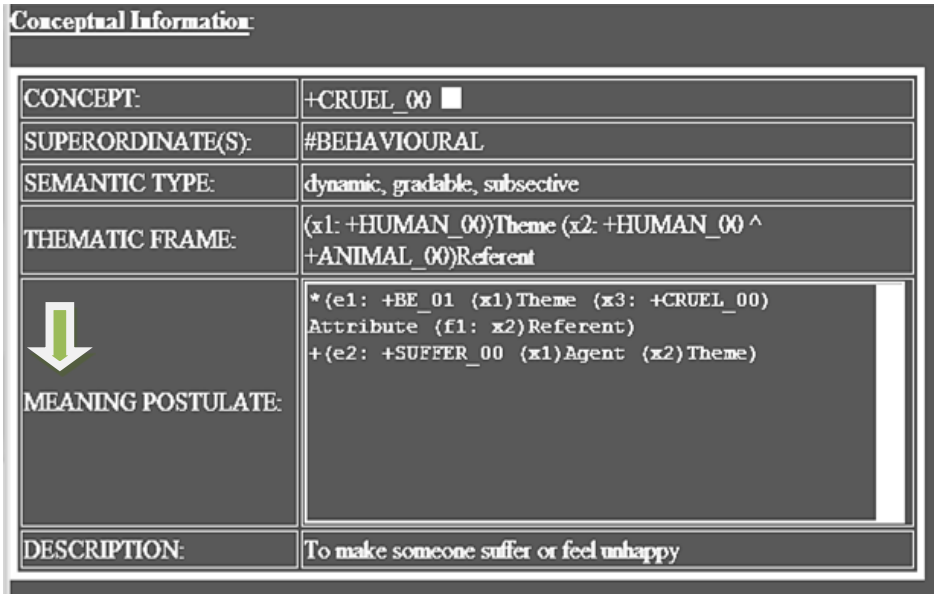

Figure 4. Meaning postulate of +CRUEL_00 in FunGramKB editor

5 Axiological representation and distribution in FunGramKB Core Ontology

Velardi et al. (1991) distinguish two well-defined strategies when describing meaning in computational lexicography: i.e. the cognitive content in a lexical unit can be described by means of semantic features or primitives (conceptual meaning), or through associations with other units in the lexicon (relational meaning). The former approach offers a stronger inferential power and guarantees the construction of a robust knowledge base applicable to most NLP tasks, consolidating thus the concept of resource reuse. However, nowadays there is no single right methodology for ontology development. Ontology design tends to be a creative process, so it is probable that two ontologies designed by different people have a different structuring (Noy and McGuinness, 2001).To avoid this problem, the ontology model should be founded on a solid methodology. The number of contributions in this field is very large and we have taken into account some key ideas from other authors having a relevant influence on the principles guiding the FunGramKB ontology (Bouaud et al., 1995; Mahesh, 1996; Noy and McGuinness, 2001; Ahmad, 2007; Barlatier and Dapoigny, 2012).

In FunGramKB, basic and terminal concepts are always stored with their ontological properties in the form of TFs (Thematic Frames) and MPs (Meaning Postulates). On the one hand, A TF is a conceptual construct which states the number and type of participants involved in the prototypical cognitive situation portrayed by concepts (Periñán-Pascual and Arcas-Túnez, 2007: 267). It must be taken into account that, unlike other ontologies, in FunGramKB every event and quality is assigned one TF. On the other hand, an MP comprises a group of one or more logically connected predications (e_1, e_2... e_n), which are conceptual

constructs carrying the generic features of concepts (Periñán-Pascual and Arcas-Túnez, 2004: 39). It also incorporates the information stated in a TF by the co-indexation of the participants.[8] Periñán-Pascual and Arcas-Túnez (2004) point out that current lexicalist models agree to handle lexical meaning as a cognitive representation reflecting the speakers` shared knowledge about the referent linked to a given linguistic expression. If we apply a syntactico-semantic description to the participants, then a set of operators allows the machine to recognize well-formed predications.

If we relate FunGramKB to the axiological parameter, in the following lines it can be observed how the axiological features are expanded and distributed throughout a set of semantic/ conceptual instruments (basic and terminal concepts, predications or satellites) and syntactic ones (predication operators such as polarity, quantification operators and logical connectors), in line with the process of stepwise conceptual decomposition characterizing FunGramKB.

5.1 Syntactic features of MPs: Operators

If Λ is a participant whose type is specified by Π, where indexed labels *x* and *f* are used by arguments and satellites respectively, then this participant can be preceded by an operator (α), which applies a specific kind of quantification to the concept expressed as a selection preference.

- Quantification Operators:

A participant can be preceded by an operator (α), which applies a specific kind of quantification to the concept expressed as a selection preference.

Feature	Value
Absolute quantifier	1 / 2 / 3 / 4 …
Relative quantifier	**m / s / p**
Indefinite quantifier	i

E.g.: **…***(e2: +BE_01 (x1)Theme (x3: **p** +SICK_00)Attribute): **$SICK_00**

Table 1. FunGramKB quantification operators

The quantification operators sensitive to axiological concepts are the relative quantifiers, particularly *m* (many or more) or *p* (a few or less), as they act as upgrading or downgrading intensifiers within the gradable semantic dimensions.

- Predication operators:

The polarity operator *n* (similar to *neg* in d-Prolog proposed by Nute (2003)) allows negative information to be explicitly stated and is the only predication operator likely to implement an axiological charge. If applied to a concept on the negative pole like +WRONG_00, then it neutralizes its negativity, as can be observed in the second example of table 2.

[8] Although the inclusion of TFs in MPs may seem redundant, it is highly necessary since it is through TFs that the mapping with the variables of the lexical templates (located in the lexical module) occurs. In other words, if TFs did not exist, the linkage between the Ontology and the different lexica would be inexistent (cf. Periñán-Pascual and Mairal-Usón, 2009).

Feature	Value
Aspectuality	ing / pro / egr
Temporality	rpast/npast /pres/nfut/rfut
Epistemic modality	cert / prob / pos
Non-epistemic modality	obl / adv / perm
Polarity	**n**

E.g.: (1) **…***(e2: **n** +BE_01 (x1)Theme (x3: +GOOD_00)Attribute): **+BAD_00**
(2)**...** +(e2: **n** +BE_01 (x1)Theme (x4: +CAREFUL_00)Attribute): **+CARELESS_00**

Table 2. FunGramKB predication operators

Finally, logical connectors used in FunGramKB: conjunction (&), disjunction (|) and exclusion (^) allow us to coordinate two axiologically-sensitive concepts in the same predication, satellite or thematic frame.

Ex: (1) Conjunction: **…** +(e2: n +BE_01 (x1)Theme (x3: +AFRAID_00 & +ANGRY_00 & +WORRIED_00)Attribute: **+CALM_00**
(2) Disjunction: **...** +(e2: +BE_00 (x1)Theme (x3: +GOD_00 | +RELIGION_00)Reference: **+HOLY_00**
(3) Exclusion: (f1: +NERVOUS_00 ^ +WORRIED_00)Manner: **$BROODING_00**

5.2 Conceptual features of MPs: Predications and satellites

Only *basic concepts* can be used in Meaning Postulates to define terminal concepts or other basic concepts. A sample of axiologically-loaded basic concepts used in the meaning postulates of relevant units are shown as follows:

+IMPORTANT_00; +BEAUTIFUL_00; +PLEASANT_00; +INTELLIGENT_00; +SICK_00; +ANXIETY_00; +COWARDLY_00; +CRUEL_00; +DECEIVE_00; +DESIRE_00; +TRUE; +FEAR_00; WEAK_00; +PLEASURE_00; +LIKE_00; +PRIDE_00; +GOOD_00; +USEFUL_00; +LAUGH_00; +ANGER_00; +INTERESTING_00; +GOD_00; +WRONG_00; +FUNNY_00; +CRAZY_00; +HAPPY_00; m +BAD_00; +WORRIED_00; +DANGEROUS_00; +DAMAGE_00, etc.

These defining units that enable the construction of meaning postulates are limited to an inventory of about 1,300 units, which come mostly from defining vocabulary in *Longman Dictionary of Contemporary English*. They can belong to any of the three subontologies (#ENTITY, #EVENT or #QUALITY) and may be found in predications or satellites as shown below:

- Predications

… *(e2: +BE_01 (x1)Theme (x3: +THIN_01 & +SICK_00)Attribute): **$CADAVEROUS_00**
...+(e2: +FEEL_00 (x2)Agent (x1)Theme (x4: +ANXIETY_00)Attribute)*: **+WORRIED_00**
… *(e2: +FEEL_00 (x2)Agent (x1)Theme (x4: +PLEASURE_00)Attribute: **+HAPPY_00**
… *(e3: +BE_01 (x3)Theme (x5: +TRUE_00)Attribute): **+SINCERE_00**

-Satellites

… (f2: (e3: +SMILE_00 (x1)Theme))Result | (f3: (e4: +LAUGH_00 (x1)Theme))Result): **+HAPPY_00**

… (f1: (e3: +SAY_00 (x1)Theme (x4)Referent (x3)Goal (f2: +GOOD_00)Manner)): **+POLITE_00**
… (f1: +EASY_00)Manner): **+CLEAR_00**
… (f1: (e3: +BE_01 (x1)Theme (x4: +WEAK_00)Attribute)):**+SICK_00**

Obviously, the most logical interaction between conceptual features and concepts under #QUALITY is that axiologically-sensitive qualities include axiologically-loaded predications in MPs as occurs with concepts describing emotions:

E.g.: # PSYCHOLOGICAL
EMOTIONAL
+(e2: +FEEL_00 (x2)Agent (x1)Theme (x4: +FEAR_00)Attribute): **+AFRAID_00**
+(e2: +FEEL_00 (x2)Agent (x1)Theme (x4: +ANGER_00)Attribute): **+ANGRY_00**
+(e2: n +BE_01 (x1)Theme (x3: +AFRAID_00 & +ANGRY_00 & +WORRIED_00) Attribute): **+CALM_00**
*(e2: +FEEL_00 (x2)Agent (x1)Theme (x4: +PLEASURE_00)Attribute (f2: (e3: +SMILE_00 (x1)Theme))Result | (f3: (e4: +LAUGH_00 (x1)Theme))Result): **+HAPPY**
*((e2: +FEEL_00 (x2)Agent (x1)Theme (x4: +ANGRY_00)Attribute (f2: (e3: +DESIRE_01 (x1)Theme (x5)Referent))Reason)(e4: +HAVE_00 (x2)Theme (x5)Referent)): **+JEALOUS_00**
+(e2: +FEEL_00 (x2)Agent (x1)Theme (x4: +PRIDE_00)Attribute): **+PROUD_00**
+(e2: n +BE_01 (x1)Theme (x4: +HAPPY_00)Attribute (f1)Referent): **+SAD_00**
+(e2: +FEEL_00 (x2)Agent (x1)Theme (x4: +ANXIETY_00)Attribute): **+WORRIED_00**

However, there are cases in which non axiologically-sensitive concepts under the #QUALITY subontology may include axiologically-loaded predications in their MPs such as “good” in +RIPE_00 or “popular” in +PUBLIC_00, as shown in the following examples:

(1) # PHYSICAL
+RIPE_00
*(e2: +BE_01 (x1)Theme (x3: ***+GOOD_00)**Attribute (f1: (e3: +INGEST_00 (x4: +HUMAN_00)
Agent (x1)Theme (x5: +THROAT_00)Location (x6)Origin (x7: +STOMACH_00) Goal))Purpose)

(2) # SOCIAL
+PUBLIC_00
*(e1: +BE_01 (x1)Theme (x2: ***+POPULAR_00**)Attribute)

5.3 Distribution of basic and terminal concepts among the metaconcepts[9]

In total, 128 out of 321 basic and terminal concepts included in the subontology #QUALITY are sensitive to inherent axiological information in their MPs. That represents, approximately, 40% of all instances. This information refers only to axiologically-sensitive concepts, but it should also be noted that there are also a few more concepts which are not intrinsically axiological but include axiologically-sensitive defining concepts in their MPs. The relevant axiolologically-sensitive concepts are distributed among the metaconcepts like this:

[9] It must be taken into account that knowledge engineers in FunGramKb Core Ontology have modeled and defined 422 concepts under the subontology #EVENT, 931 under #ENTITY and 321 under #QUALITY. According to previous studies (Felices-Lago and Cortés de los Ríos [forthcoming]), 103 basic and terminal concepts under #EVENT have proved to be sensitive to the axiological parameter (25%), whereas only 74 basic and terminal concepts under #ENTITY (8%) have proved to be axiologically-loaded (see Felices *et al*. in this journal, vol.3, no.1 (2012), pp. 51-60).

(1) #PSYCHOLOGICAL
  (1.1) #EMOTIONAL: 31
  (1.2) #BEHAVIOURAL: 26
  (1.3) #COGNITIVE: 12
  TOTAL: 69
(2) #SOCIAL: 33
(3) #PHYSICAL: 24
(4) #QUANTITATIVE: 2

The #TEMPORAL and #SPATIAL metaconcepts do not include axiologically-sensitive concepts.

The most relevant finding of the distribution of axiologically-sensitive concepts under the subontology #QUALITY is the high number of occurrences under the metaconcept #PSYCHOLOGICAL (more than half of the set of concepts selected) and, particularly, the balance between concepts under its subordinate metaconcept #EMOTIONAL and concepts under #BEHAVIOURAL. This is not unusual due to the close connection between emotions and conduct and the prominent role played by adjectives to describe emotional and behavioral phenomena in human beings or, to a lesser extent, in animals.[10] It is surprising that concepts under #PHYSICAL also reach a prominent position (24 examples), very close to the number of occurrences under #SOCIAL (33 examples). In fact, intuitively, we would expect this metaconcept to be the leading domain or, at least, at the same level as #PSYCHOLOGICAL.

5.4 Distribution of concepts from the Core Ontology in the axiologically-loaded dimensions

As shown in the previous section, the number of axiologically-loaded concepts under #QUALITY subontology amount to 128 occurrences (including those intrinsically affected by operators). Their distribution among the axiological dimensions referred to in figure 5 is as follows:

A) GENERIC AXIS
Prototypical evaluative concepts:
+BAD_00, $BAD_00, +GOOD_00, $GOOD_00

B) SPECIFIC AXIS
1a) Emotion (Behaviour) or Hedonism: +AFRAID_00, $AFRAID_00, +ANGRY_00, $ANGRY_00, +CALM_00, +CRAZY_00, $CRAZY_00, $CRAZY_01, $CRAZY_N_00, +EAGER_00, $FRAGRANT_00, +HAPPY_00, $HAPPY_00, $IMPATIENT_00, $IMPATIENT_N_00, $INSANE_00, +JEALOUS_00, $MELODIOUS_00, +NERVOUS_00, +PLEASANT_00, $PLEASANT_00, $PLEASANT_N_00, +SAD_00, $SAD_00, +SENSITIVE_00, +SERIOUS_00, $SERIOUS_N_00, +SORRY_00, $SORRY_00, +SWEET_00, $TASTY_00, $VESANICO_00, +WORRIED_00, $WORRIED_00.
1b) Behaviour (Emotion): +BORING_00, +CAREFUL_00, $CAREFUL_00, +CARELESS_00, +CRUEL_00, +COWARDLY_00, $COWARDLY_N_00, +DISHONEST_00, $DISHONEST_N_00, +DANGEROUS_00, $DANGEROUS_N_00,

[10] This assumption has been deeply explored since antiquity. See in particular the Plato and Aristotle theory of the GCB (Great Chain of Being) (Krzeszowski, 1997) and also, from a more scientific perspective, see the classical theories of emotion in modern psychology (W. James, 1884).

+FRIENDLY_00, $FRIENDLY_N_00, +FUNNY_00, +GENEROUS_00, $GENEROUS_00, $GENEROUS_N_00, $HASTY_00, +NOISY_00, $NOISY_00, $NOISY_N_00, +POLITE_00, $POLITE_N_00, +SINCERE_00, $SINCERE_N_00, $TIDY_00, +VIOLENT_00, $VIOLENT_N_00.
2) Veracity: +LEGAL_00, $LEGAL_N_00, +REAL_00, $REAL_N_00, +TRUE_00, TRUE_N_00, +WRONG_00, $WRONG_N_00.
3) Vitality: +ALIVE_00, $CADAVEROUS_00, $CLAMMY_00, +DIRTY_00, $DIRTY_N_00, +FRAGILE_00, $FRAGILE_00, $OBESE_00, +OLD_00, $OLD_N_00, $PINCHED_00, +PURE_00, $PURE_N_00, $SENILE_00, +SICK_00, $SICK_00, $SICK_N_00, +STRONG_00, +TIRED_00, $TIRED_N_00, , +WEAK_00.
4) Aesthetics: +BEAUTIFUL_00, +BIG_01, $BULKY_00, +UGLY_00.
5) Prominence: $EMINENT_00, +FAMOUS_00, $FAMOUS_N_00, +IMPORTANT_00, $IMPORTANT_00, $IMPORTANT_01, $IMPORTANT_N_00, +INTERESTING_00, +POPULAR_00, $POPULAR_N_00, +PROUD_00, +ROYAL_00.
6) Function/Pragmatism: + DIFFICULT_00, +EASY_00, +USEFUL_00, +USELESS_00, $OBSOLETE_00.
7) Economy/Material: +EXPENSIVE_00, $EXPENSIVE_N_00, +FREE_00, +RICH_00, RICH_N_00.
8) Religion: +HOLY_00
9) Intellect: +CLEAR_00, $CLEAR_N_00, +INTELLIGENT_00, $INTELLIGENT_01, $INTELLIGENT_N_00.

Figure 5: Distribution of concepts among axiological dimensions

62 out of 128 concepts refer to emotions linked to behaviour or behaviour linked to emotional processes. That is almost half of all occurrences and implies that emotional and behavioural concepts tend to be the most prototypically sensitive to the axiological axis and, in consequence, this affects a considerable number of concepts under the #QUALITY subontology. It can be considered normal that prototypical evaluative concepts such as "good" or "bad" are reduced in quantity, but not in frequency, as they are widely used to define axiologically-sensitive concepts in this and the other two subontologies. It is also worth noting that the ontological units which refer to the vitality dimension amount to twenty-one cases, which is a significant quantity, particularly when it is compared with previous subontological analyses (Felices-Lago *et al.* 2012 and forthcoming). Socio-ethical non-behavioural concepts or those which generally refer to the areas of *prominence*, *veracity*, *economy* or *religion* totalize 26 instances (20%).This percentage meets our previous expectations and can be rated as a predictable result. However, the amount of concepts under *intellect* or *function/pragmatism* (5 units each) is considerably high if compared to the previous analyses in the #ENTITY or #EVENT subontologies, particularly when no match could be found in two out of four classifications. Consequently, it can be claimed that these two axiological categories are better grounded in the adjectival subontology.

6 Conclusions

The previous discussion of the analyzed data facilitates the most outstanding result: the impact of the axiological classeme in the FunGramKB Core Ontology can be defined as substantial, particularly in the #QUALITY subontology, as 40% of all instances are sensitive to this parameter. Consequently, it can be claimed that there is a solid foundation to consider #QUALITY as more sensitive to the axiological parameter than #EVENT or #ENTITY.

In general terms, it has been observed how the axiological features are expanded and distributed throughout a set of semantic-conceptual instruments (basic concepts used to define MP predications or satellites or those used to define terminal concepts) and/or syntactic-semantic ones (predication operators such as quantification or polarity) in line with the process of stepwise conceptual decomposition characterizing FunGramKB. This reinforces *evaluation* as a fact of crucial importance for a well-founded understanding of the relationship between lexical structure and cognition.

The results obtained in the present study have shown the high number of axiologically-sensitive concepts under the metaconcept #PSYCHOLOGICAL (more than half of the corpus selected) and, particularly, the connection between #BEHAVIOURAL and #EMOTIONAL. This finding provides further evidence about the axiological link between conduct and emotion and also, to a certain extent, the way in which a group of concepts under the #COGNITIVE metaconcept also act as a bridge between emotion and perception. Furthermore, it has been proved that concepts under #SOCIAL or #PHYSICAL also reach a prominent position and become leading axiologically-sensitive conceptual domains.

To sum up, we can conclude that the proposal to insert axiological notations in FunGramKB ontology, in the FunGramKB lexica under construction, or additionally in other levels of meaning description in the Lexical Constructional Model, should be explored as a key factor for meaning construction. The results of this research as well as the two previous studies in the same vein for the #EVENT and #ENTITY subontologies should be taken as stepping stones in that direction.

7 Acknowledgements

The research described in this article is part of the project entitled: *Elaboración de una subontología terminológica en un contexto multilingüe (español, inglés e italiano) a partir de la base de conocimiento FunGramKB en el ámbito de la cooperación internacional en materia penal: terrorismo y crimen organizado*, funded by the Spanish Ministry of Economy and Competitiveness. Code: FFI2010-15983.

***

8 References

Aarts, J. and Calbert, J. (1979): *Metaphor And Non-Metaphor: The Semantics of Adjective-Noun Combinations*. Tübingen: Max Niemeyer.

Ahmad, K. (2007). "Artificial Ontologies and Real Thoughts: Populating the Semantic Web?". In Basili, R. and Pazienza, M.T. (eds): *AI*IA 2007: Artificial Intelligence and Human-Oriented Computing, LNAI 4733*. Berlin: Springer, 3-23.

Allen, J. F. (1983). "Maintaining knowledge about temporal intervals", *Communications of the ACM* 26 (11), 832-843.

Barlatier, P. and Dapoigny, R. (2012). "A type-theoretical approach for ontologies: The case of roles", *Applied Ontology*, 7, 311–356

Bouaud, J. et al. (1995). "Methodological principles for structuring an ontology. In *IJCAI`95: Workshop on Basic Ontological Issues in Knowledge Sharing.* Montreal.

Cortés-de-los-Ríos, Mª E. (2001). *Nuevas perspectivas lingüísticas en la publicidad impresa anglosajona.* Almería: University of Almería.

Coseriu, E. (1967). Lexicalische Solidaritäten. In *Poetica*, 1, 293-303.

Coseriu, E. (1968). Les structures lexématiques. In Elbert, W. Th. (ed): *Probleme der Semantik.Beiheft 1 (Neue Folge) Zeitschrift für französische Sprache und Literatur*. Wiesbaden, 13-16.

Coseriu, E. (1977). *Principios de semántica estructural.* Madrid: Gredos.

Dik, S. C. (1978). *Stepwise Lexical Decomposition.* Lisse: The Peter De Ridder Press.

Dik, S. C. (1989). *The Theory of Functional Grammar. Part I: The Structure of the Clause.* Dordrecht: Foris.

Escalier, M. Ch. and Fournier, C. (1997). "Towards a Notional Representation of Meaning in the Meaning-Text Model: The Case of the French SI". In Wanner, L. (ed): *Recent Trends in Meaning Text Theory.* Amsterdam: John Benjamins, 25-55.

Faber, P. and Mairal-Usón, R. (1999). *Constructing a Lexicon of English Verbs*. Berlin / New York: Mouton de Gruyter.

Felices-Lago, Á. (1991). *El componente axiológico en el lenguaje. Su configuración en los adjetivos que expresan emociones y conducta en la lengua inglesa*. Ph. D. Dissertation. Granada: University of Granada.

Felices-Lago, Á. (1997a). "The Integration of the Axiological Classeme in an Adjectival Lexicon Based on Functional-Lexematic Principles". *A Fund of Ideas: Recent Developments in Functional Grammar*, C.S. Butler, et alii (eds.). Amsterdam: IFOTT, 95-112.

Felices-Lago Á. (2003). "Reformulation of the domain-level semantic pattern of axiological evaluation in the lexicon of English verbs". *Hermes*, 30, 179-198.

Felices-Lago, Á. And Cortés-de-los-Ríos, Mª E. [forthcoming]. "The implementation of the axiological parameter in FunGramKB: the case of the #EVENT subontology", *Evaluation in Context.* Laura Alba-Juez & Geoff Thompson (eds.). Amsterdam: John Benjamins.

Hare, R.M. (1952). *The Language of Morals.* London: Clarendon Press. (Oxford University Press, 1964).

Katz, J. J. (1964). "Semantic Theory and the Meaning of 'Good`". *The Journal of Philosophy* LXI, 23. 739-766.

Krzeszowski, T. P. (1990). "The Axiological Aspect of Idealized Cognitive Models". In Tomaszczyk, J. and Lewandowska, B. (eds) *Meaning and Lexicography.* Amsterdam: John Benjamins, 135-165.

Krzeszowski, T.P. (1993). "The Axiological Parameter in Preconceptual Image Schemata". In

Geiger, R.A. and Rudzka-Ostyn, B. (eds): *Conceptualizations and Mental Processing in Language*. Berlin: Mouton de Gruyter, 307-330.

Krzeszowski, T. P. (1997). *Angels and Devils in Hell. Elements of Axiology in Semantics.* Warsaw: Energeia.

Leech, G. (1975). *Semantics.* Marmondsworth: Penguin.

Lyons, J. (1977). *Semantics.* Cambridge: Cambridge University Press.

Mahesh, K. (1996). *Ontology Development for Machine Translation: Ideology and Methodology.* Technical report MCCS-96-292. Computing Research Laboratory, New Mexico State University, Las Cruces.

Mairal-Usón, R. and Periñán-Pascual, C. (2009). "The anatomy of the lexicon component within the framework of a conceptual knowledge base". *Revista Española de Lingüística Aplicada*, 22, 217-244.

Mairal-Usón, R. and Ruiz de Mendoza-Ibáñez, F.J. (2008). "New challenges for lexical representation within the Lexical-Constructional Model". *Revista Canaria de Estudios Ingleses*, 57, 137-158.

Mairal-Usón, R. and Ruiz de Mendoza-Ibáñez, F.J. (2009). "Levels of description and explanation in meaning construction". In Butler, Ch. and Martín-Arista, J. (eds.) *Deconstructing Constructions.* Ámsterdam: John Benjamins, 153–198.

Martin, J.R. and White, P.R.R. (2005). *The Language of Evaluation. Appraisal in English*. NewYork: Palgrave Macmillan.

Martín-Mingorance,L. (1987). "Classematics in a Functional-Lexematic Grammar of English". *Actas del X Congreso de AEDEAN*,AEDEAN, Zaragoza, 377-388.

Martín-Mingorance, L. (1990). "Functional Grammar and Lexematics in Lexicography". Tomaszczyk, J. and Lewandowska, B (eds): *Meaning and Lexicography.* Amsterdam: John Benjamins, 227-253.

Martín-Mingorance, L. (1995). "Lexical Logic and Structural Semantics. Methodological Underpinnings in the Structuring of a Lexical Database for Natural Language Processing". In Hoinkes, Ulrich (ed): *Panorama der Lexicalischen Semantik.* Tübingen: Gunter Narr, 461-474.

Martín-Mingorance, L. (1998). *El modelo lexemático-funcional*. Amalia Marín Rubiales (ed). Granada: University of Granada.

Nida, E. (1975). *Exploring Semantic Structures*. Munich: W. Fink.

Osgood, Ch., Suci, G. and Tannenbaum, P. (1957). *The Measurement of Meaning.* Chicago: Illinois University Press.

Noy, N.F. and McGuinness, D.L. (2001). *Ontology Development 101: A Guide to Creating your First Ontology.* Technical report KSL-01-05. Stanford Knowledge Systems Laboratory, Stanford University.

Nute, D. (2003). "Defeasible logic: theory, implementation, and applications," In Oskar Bartenstein, Ulrich Geske, Markus Hannebauer, Osamu Yoshie (eds.), *Web Knowledge Management and Decision Support:Proceedings of INAP 2001, 14th International Conference on Applications of Prolog (Revised Papers)*, Berlin: Springer-Verlag, 151-169.

Pauwels, P. and Simon-Vandenbergen, A.-M. (1993). "Value Judgment in the Metaphorization of Linguistic Action". In Geiger, R.A., Rudzka-Ostyn, B (eds): *Conceptualizations and Mental Processing in Language.* Berlin: Mouton de Gruyter, 331-367.

Pauwels, P. and Simon-Vandenbergen, A.-M. (1995). "Body Parts in Linguistic Action: Underlying Schemata and Value Judgments". In Goossens, L., Pauwels, P. et alii (eds): *By Word of Mouth: Metaphor, Metonymy and Linguistic Action in a Cognitive*

Perspective Amsterdam: John Benjamins, 35-70.
Periñán-Pascual, C. and Arcas-Túnez, F. (2004). "Meaning postulates in a lexico-conceptual knowledge base". *15th International Workshop on Databases and Expert Systems Applications*, IEEE, Los Alamitos (California), 38-42.
Periñán-Pascual, C. and Arcas-Túnez, F. (2007). "Cognitive modules of an NLP knowledge base for language understanding". *Procesamiento del Lenguaje Natural* 39, 197-204.
Periñán-Pascual, C. and Mairal-Usón, R. (2009). "Bringing Role and Reference Grammar to natural language understanding". *Procesamiento del Lenguaje Natural*, 43, 265-273.
Periñán-Pascual, C. and Mairal-Usón, R. (2010). "La Gramática de COREL: un lenguaje de representación conceptual". *Onomázein* 21 (2010/1), 11-45.
Pottier, B. (1964). "Vers une sémantique modern". *Travaux de linguistique et literatura* 2.1, 101-137.
Ruiz de Mendoza, F. J. and Mairal Usón, R. (2008). "Levels of description and constraining factors in meaning construction: an introduction to the Lexical Constructional Model". *Folia Linguistica* 42/2, 355-400.
Simon-Vandenbergen, A.-M. (1995). "Assessing Linguistic Behaviour: A Study of Value Judgements". In Goossens, L., Pauwels, P. et alii (eds): *By Word of Mouth: Metaphor, Metonymy and Linguistic Action in a Cognitive Perspective.* Amsterdam: John Benjamins, 71- 123.
Stati, S. (1979). *La sémantique des adjectifs: Essai d'analyse componentielle appliqué aux langues romanes.* Paris: Jean Favard.
Van Valin, R.D. Jr. (2005). *The Syntax-Semantics-Pragmatics Interface: An Introduction to Role and Reference Grammar*, Cambridge: Cambridge University Press.
Van Valin, R.D. Jr. & R. LaPolla (1997). *Syntax, Structure, Meaning and Function*, Cambridge: Cambridge Univ. Press.
Velardi, P., Pazienza, M.T. and Fasolo, M. (1991). "How to encode semantic knowledge: a method for meaning representation and computer-aided acquisition". *Computational Linguistics* 17, 2. 153-170.