NEW DEVELOPMENTS IN THE F(unctional) L(exematic) M(odel)[1]

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1. INTRODUCTION

One of the major points of agreement in contemporary grammatical theory is the centrality of the lexicon as a repository of information about sentence structure. It is a secret to no one that in recent years, many linguistic theories have undergone a gradual change in paradigm, discarding syntactically-oriented postulates in favor of more lexically-based approaches. The fact that the lexicon is presently in the spotlight signifies that linguists have finally realized that lexemes (and the different types of information they convey) are the building blocks of language in all senses. One of the issues currently at hand is how lexical entries should be configured, and what information should be included in them.

One of the most coherent proposals for the structure of a lexical entry has been made within the framework of Simon Dik's Functional Grammar (FG), in which each predicate is described in terms of a predicate frame, which includes its form, syntactic category, quantitative valence, qualitative valence, and meaning definition. Proof of the relevance of these parameters is the fact that they appear as well in many other grammatical models, both formal and functional. Nevertheless, it is our assertion that the present parameters of lexical organization in FG (as well as other lexicon-based grammatical models), though basically correct, are insufficient to account for a speaker's actual lexical knowledge.

In this regard, the Functional-Lexematic Model (FLM) developed by Martín Mingorance (1984; 1985 ab; 1987 abc;1990;1995) is an enrichment of the FG lexicon component. Indeed, one of the principal merits of the FLM is that it provides the FG lexicon with an onomasiological orientation based on meaning structure, and provides the means by which the lexicon of a given language is structured in terms of a set of lexical domains. The two basic axes of this type of lexical structure are the following:

a) the paradigmatic axis, which deals with the structuring of lexical domains in subdomains and the development of a system of definitions based on semantic hierarchies.

b) the syntagmatic axis, which is concerned with the analysis and encoding of the complementation patterns of each lexeme, using predicate frames as integrated formulae.

The lexical organization obtained in this way is highly informative, since both the micro- and macrostructure of lexical domains are indicative of the complex relation between syntax and semantics.

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[1] This research was carried out within the framework of the *project Desarrollo de una lógica léxica para la traducción asistida por ordenador a partir de una base de datos léxica inglés-francés-alemán-español multifuncional y reutilizable*, funded by the Spanish Ministry DGICYT PB 94/0437.

However, our claim is that lexical structure on both the paradigmatic and syntagmatic axes reflects cognition. Lexical relations at different levels of the lexicon encode a map of conceptual relations and give us a tantalizing glimpse of «mentalese», a language of thought which compared to any given language is «richer in some ways and simpler in others» (Pinker, 1994). This «language of thought» can be derived in part from the predicates and arguments of lexical meaning, as well as their configurations on both the paradigmatic and syntagmatic axes. Efforts to trace this map have so far met with little success, partly because of the many different types of information that must be taken into account, and partly because of the complex interconnections present in any knowledge representation.

This claim has led us to postulate a third axis, viz. the cognitive axis, which would be the intersection point of language and thought. On this axis, meaning is conceived as an internal knowledge representation, or as a set of cognitive products and procedures which elaborate and process information. In this regard, lexical meaning is in itself a cognitive model in which part of our knowledge about the world is symbolized by a linguistic expression. Thus, lexical units are conceived as «translations» of our interpretation of perceptual data because they and their combinatorial possibilities are the external representations of our model of the world[2].

2. Methodological underpinnings for the construction of the cognitive axis in an FG lexicon

Both linguists and psychologists have long been aware of the significance of lexical structure as a means of ascertaining and exploring the organization of concepts in the mind. This awareness has logically coincided with a growing interest in issues such as knowledge engineering, artificial intelligence, and psycholinguistic research in categorization, areas in which the study of conceptual structure is vitally important (Connolly, 1990). The close relationship between language and thought has led to the realization that in an adequate psychological account of human mental life, linguistic competence must play a central role (Miller, 1990: 321).

At all levels, language structure is eloquent proof that we are not passive recipients of information, but active experiencers and interpreters of a world upon which we impose a certain organization. It is well-known that humans are uniquely endowed with the capacity to build complex, flexible and creative *linguistic* and *conceptual* systems (Waxman, 1994: 229). Of the small set of basic conceptual structures which relate senses by connecting them to people's shared knowledge of the world, the most important is categorization. In fact one of our first tasks in life is to form categories that capture the different traits and features objects share and to learn words that describe these categories.

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[2] Such a language of internal meaning representation is necessary in order to adequately explain translation (among other things). To translate a text from one language to another, there must be a conceptual representation shared by both. This is the basis of the interlingua approach in Machine Translation in which a pivot language or non-language-specific representation is used to transfer meaning from the source language to the target language. In fact, FG underlying clause structures are conceived of as the interlingua in an MT system (cf. Dik, 1986; Van der Korst, 1990). In this connection, we believe that predicate schemata are the lexical interlingual representation of the lexical storage of a language.

Categorization is the major psychological principle governing lexical structure. Within the lexicon, lexemes form a complex network in which each lexeme is connected to others by many different types of relations. Categorization can be approached by means of prototypes or schemata. Most linguists seem to prefer categorization by prototype instead of by schema. In this regard, Taylor (1989: 67) claims that it is not possible to abstract a schema which is compatible with all members of a category. However, we argue in favor of categorization by schema because we have found that such structures are reflected in lexical organization, which in turn is the symbolic representation of cognitive processes. Nevertheless, it is not enough just to talk about the existence of schemata. (In Cognitive Psychology, this has been going on for some time.) A more useful course of action is to examine to what extent such schemata are reflected in language structure and how they are implemented in the lexicon. This is precisely the initial task of the cognitive axis.

The encoding of the cognitive axis is based on the following principles:

a) Lexical structure is a repository of forms whose configuration and storage encode essential information about our thought processes. It is not as Disciullo and Williams (1987) claim, a prison which incarcerates a conglomeration of «lawless listemes», whose only dubious merit is that they must be memorized.

b) The convergence of the information conveyed in both the paradigmatic and the syntagmatic axis gives rise to a series of what we have termed predicate schemata. The FG lexicon, organized in terms of a hierarchical network of predicate schemata, enriches the lexicon component by making it more dynamic and capable of accounting for the full potentiality of the lexical competence of the natural language user.

c) Consequently, this type of lexical organization necessarily entails certain modifications in FG because semantic domains, as we conceive them, are in themselves lexical micro-grammars in which pragmatic, semantic and syntactic regularities converge. In this sense, an FG lexicon structure according to FLM principles, can be regarded as a core lexical grammar formed by rules and procedures the specific realization of which is field-bound.

We postulate that both the information codified in the paradigmatic and the syntagmatic axis is iconically motivated. Given a lexical subdomain, we observe that the superordinate term governing it tends to take a greater number of complementation patterns than its more specific hyponyms. In fact, as we move down the scale (from the most general to the most specific), the number of syntactic patterns decreases. Consider the subdomain *to think about something in order to make a decision in the future* from the lexical domain COGNITION:

(1) TO THINK ABOUT STH

→ CAREFULLY & DELIBERATELY [*plan:* SVO, SVO-Inf, SVP-*for* O, SVO-*That*, SVPO, SVO-*ing*]

→ SECRETLY [*plot:* SVO, SVO-Inf, SVP-*against* O]

→ DEVIOUSLY [*scheme:* SVO, SVO, Inf, SVP-*against* O]
DISHONESTLY [*connive:* SVO, Inf, SVP-*against* O]
WITH OTHERS [*conspire:* SVO-Inf, SVP-*against* O]
FOR ONESELF [*intrigue:* SVO, Inf, SVP-*against* O]

This diagram shows that in the same way that there is an inheritance of meaning components in the hierarchy, there is also a similar inheritance of subcategorization patterns. The linguistic encoding of both the semantic and the syntactic information is not random but follows a certain order. We have formulated this idea in terms of the following iconic principle:

> *Principle of Lexical Iconicity*
> The greater the semantic coverage of a lexeme is, the greater its syntactic variations.
> This can also be paraphrased as follows:
> The more prototypical a term is, the more prototypical effects it will show.

In other words, the convergence of the paradigmatic and syntagmatic axes gives rise to a set of predicate schemata . These cognitive constructs are conceived as an expansion of S.C. Dik's notion of predicate frame, and encode the syntactic scenario shared by the lexemes in each lexical subdomain, as well as the pragmatic and the semantic information they contain.

2.1. The notion of predicate schema

Broadly speaking, a *schema* is an underlying organizational pattern of cognitive perception which encodes both mental and physical experience. On a cognitive level, it is well known that human beings have plans for coping with recurring sequences of basic actions. These plans or *schemata* are involved in the storing of information concerning stereotyped situations, global patterns of knowledge or generalized events (Schank, 1975). They are our means of recognizing and interpreting new information. According to Langacker (1987: 371), a schema, in contrast to a prototype, is defined in the following way:

> ...an abstract characterization that is fully compatible with all the members of the category it defines (so membership is not a matter of degree); it is an integrated structure that embodies the commonality of its members, which are conceptions of greater specificity and detail that elaborate the schema in contrasting ways.
>
> Based on Langacker's definition of schema, a predicate schema can be defined as:
>
> A domain-level predicate schema is a *modular, dynamic* characterization that subsumes *linguistic* symbolic units obtained in a bottom-to-top fashion through the activation of lower-level schemata. These schemata are linguistically motivated and reflect our understanding of reality.

By *modular*, we mean that predicate schemata are organized hierarchically within lexical domains. This allows for the elaboration of grammars of individual languages within a more general or specific area of meaning. To this effect, underlying predications are constructed on the basis of predicate schemata at different levels within the hierarchy of lexical subdomains.

By *linguistic*, we mean that the units which embody a predicate schema are obtained through semantic structure. As they are linguistic items, they do not belong to any type of metalanguage (cf Dik, 1986: 3-4). This contrasts with other approaches such as Jackendoff's (1983, 1987, 1992) Conceptual Semantics (e.g. the use of semantic functions such as GO, CAUSE etc.), the MIT Lexicon Project's Lexical Conceptual Structures, or Role and Reference Grammar's Logical structures where the use of a metalanguage in meaning definitions has become a methodological tenet (Van Valin, 1990, 1993).

By *dynamic*, we mean that these predicate schemata are not conceptualized as frozen structures. On the contrary, schemata often experiment mutations and establish connections with other schemata, a process which is the basis of metaphor and metonymy. For

example, the following chart represents the dynamic nature of some lexemes belonging to COGNITION:

(2)

SEMANTIC NET: DOMAIN OF COGNITION. Interrelations with other domains

Related Domain	Examples of verbs of COGNITION with semantic connections to other domains
EXISTENCE [happen: to exist in time]	*foresee to know sth will happen*
VISUAL PERCEPTION [*look at: to see by intentionally directing your eyes*]	view to believe that sb / sth is a certain way (by *looking* at them in your mind)
LIGHT [*mental light = knowledge]*	enlighten to cause sb to understand (see) sth better (as if by *shining light* on it).
ACTION [*do*]	plan to think out sth (esp. a method or a way of *doing* sth carefully and deliberately
FEELING [*feel*]	perplex to confuse sb making them *feel* slightly worried because they do not understand
SPEECH [*say]*	persuade to cause sb to believe that sth is true *by words (saying sth)* or behavior (acting in a certain way)
POSSESSION [*obtain: to come to have sth*]	swindle to deceive sb in order to *obtain* sth valuable from them

It is evident that the domain of COGNITION is extraordinarily complex with a variety of connections to other lexical domains. Although the *genus* of *foreseen, view, enlighten, plan, perplex, persuade,* and *swindle* place these verbs squarely in the domain of COGNITION, their respective *differentiae* contain verbs which signal connections to other domains.

For example, *swindle* is a kind of deceiving (to cause sb *to think* sth that is not true). Despite the fact that it is a verb of COGNITION, its location in a causative subdomain makes it more action-like. In the secondary part of the definition, we see that the reason for swindling sb else is to come to have something. This signals the fact that in this case COGNITION is directly related to POSSESSION. Much the same is also true of the other verbs whose adverbial modification encode interdomain relations. The fact that COGNITION has such a multiplicity of interconnections with other domains shows how central it is to our existence. The connections mentioned above show that the lexicon is not a frozen taxonomy of lexemes, but rather an intricate web of meaning relations, which show how the natural language user lexicalizes a given area of meaning.

2.2. The form and representation of a predicate schema

A predicate schema is as an expansion of the notion of predicate frame as formulated within FG, and contains the set of productive linguistic features found within a given subdomain[3]. Its form relies heavily on the meaning potential of meaning definitions, somet-

[3] In this regard, we think that the integration of the work done within Construction Grammar framework (cf. Goldberg, 1992) will prove to be very useful in the future since we could affirm that a predicate schema is in itself a type of construction.

hing that contrasts with the ancillary status to which meaning definitions have been relegated within FG.

Predicate schemata operate both from an inter- and intra-domain perspective. For example, in order to understand verbs which encode our knowledge of a particular semantic area (*movement, perception, cognition, feeling*, etc.), one must first understand our lexical representation of this area (intradomain categorization as represented by lexeme- and subdomain-level schemata), and secondly, how this understanding is related to other large conceptual areas of meaning (interdomain categorization as represented by domain-schemata). As shown below, the format of a predicate schema will be sensitive to both these types of analysis:

(3) *Format of a predicate schema*

A. Intra-domain analysis

Lexical domain

Lexical subdomain

A.1. Typology of paradigmatic prototypes

1.1. Major lexical units

1.1.1. Definiens (extensional properties)

1.1.2. Semantic parameter 1: intensional properties

1.1.3. Semantic parameter 2: intensional properties

1.1.4. Semantic parameter N: intensional properties

1.2. Pragmatic prototypes

1.2.1. Cognitive / perceptual attributes: axiological features

1.2.2. World-external pragmatic information

1.2.3. World-internal pragmatic information

A.2. Typology of syntagmatic prototypes

2.1. Prototypical syntagmatic features

2.1.1. Transitivity classeme: SoAs variable

2.1.2. Quantitative valence ($x_1 \ldots x_n$)

2.1.3. Operators

2.1.4. Qualitative valence: semantic functions

2.1.5. Selection restrictions on the participants

B. Inter-domain connections

B.1. Semantic macronet

1.1. Type of movement

1.1.1. Primary vs. secondary connections

1.2. Scope of movement

1.3. Taxonomy of lexical metaphors

By converging both the syntagmatic and the paradigmatic features encoded in the predicates within this schema, it is possible to elaborate the following representation from which a set of lexical rules can be derived (cf. Section 3):

(4)

[Σ: (PREDICATE) (Σ)] SoAs + SEMANTIC DOMAIN / DIM + (METAPHORICAL PROJECTIONS.))

PREDICATE FRAME

PREDICATE SCHEMA

For example, the following is the formalized version of the lexical subdomain of PROMISE verbs in the domain of SPEECH:

(5) *Predicate schema SPEECH domain (verbs of promise)*

[Σ: [say_V (x1)Ag (x2)Rec (Prob X [e: [intendv (x1)Ag (Prob e1)] (o2: future)$_{Time}$])$_{Go}$]]
ACTION DITRANSITIVE / SPEECH (Σ)]

Subdomain schemata are marked by a variable Σ, in contrast to domain schemata which are signaled by a variable Ω. From this characterization the following two basic assumptions can be derived: Firstly, an ACTION DITRANSITIVE schema is syntagmatically encoded, and secondly, paradigmatic semantic parameters pertaining to SPEECH are activated (cf. Mairal, 1997).

2.3. Towards a typology of predicate schemata

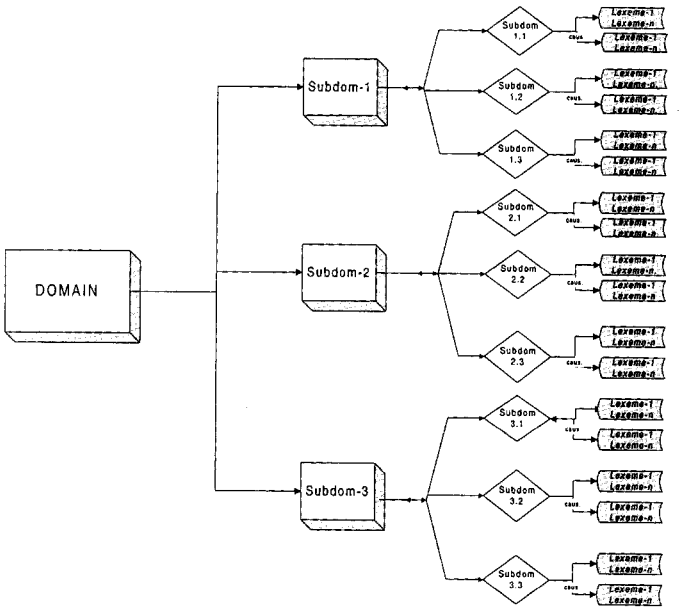
Predicate schemata can be found at different levels of the lexicon, more specifically at the levels of lexeme, domain and subdomain. The most basic type of schema is naturally that found in each individual lexeme in which syntactic, semantic and pragmatic units combine to form a pattern representing our knowledge of the lexical item in question and the area of meaning to which it belongs. The second type is a subdomain-level schema made up of those prototypical syntactic, semantic and pragmatic units obtained through the factorization of the lower-level (or lexeme-level) schemata. Finally, the most general type is a domain-level schema which is obtained in a similar way through factorization from lower-level schemata. A lexical domain thus has the following macrostructural pattern.

(6) DOMAIN SCHEMA

Subdomain-level schema- 1	Subdomain-level schema-2
Lexeme-Schema	Lexeme-Schema
Lexeme-Schema	Lexeme-Schema
Lexeme-Schema	Lexeme-Schema
Subdomain-level schema- 3	Subdomain-level schema-4
Lexeme-Schema	Lexeme-Schema
Lexeme-Schema	Lexeme-Schema
Lexeme-Schema	Lexeme-Schema

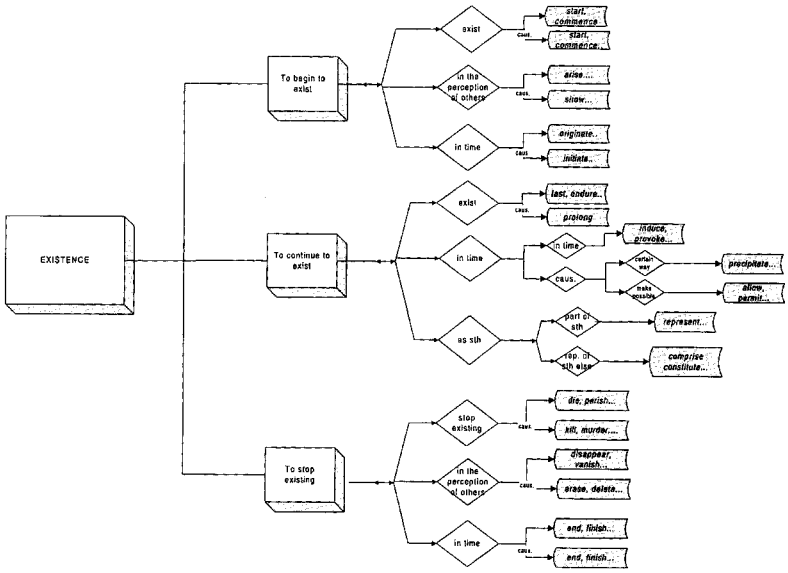
The choice of one lexeme over another will be conceived as a set of paradigmatically-oriented instructions which will eventually lead us to the actual speaker's lexical choice:

(7)



When this type of hierarchical structure is applied to a specific lexical domain, in this case, EXISTENCE, the instantiation would be the following:

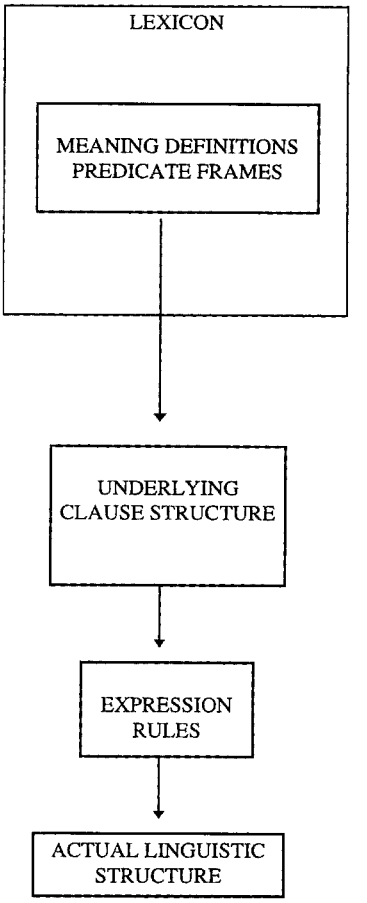
(8)



3. The linking algorithm

This type of lexical organization modifies the FG derivational scheme, and more particularly what is known as the linking algorithm. As is well known in present FG theory, a predicate frame is constructed in the Lexicon. After term insertion and the application of the appropriate subset of operators the underlying clause structure is constructed. This construct serves as input to the FG expression rule component which ultimately gives rise to the actual linguistic expression as shown in the following diagram:

(9)



From a semantically-based description of the clause, FG establishes links at two different points of clause derivation. The first linking algorithm is concerned with the assignment of the syntactic functions of participants and is regulated by what is called the Semantic Function Hierarchy (cf. Dik, 1989: chaps. 10-11). It is activated between the core and the extended predication, and is mainly concerned with the assignment of the syntactic functions, Subject and Object.

The second link falls under the scope of expression rules and encapsulates a set of morphosyntactic principles which are primarily concerned with the form, order and prosodic contours of the underlying clause structure. The expression rule component thus serves as a bridge between the structure and the actual expression of the clause.

3.1. Towards a new linking algorithm

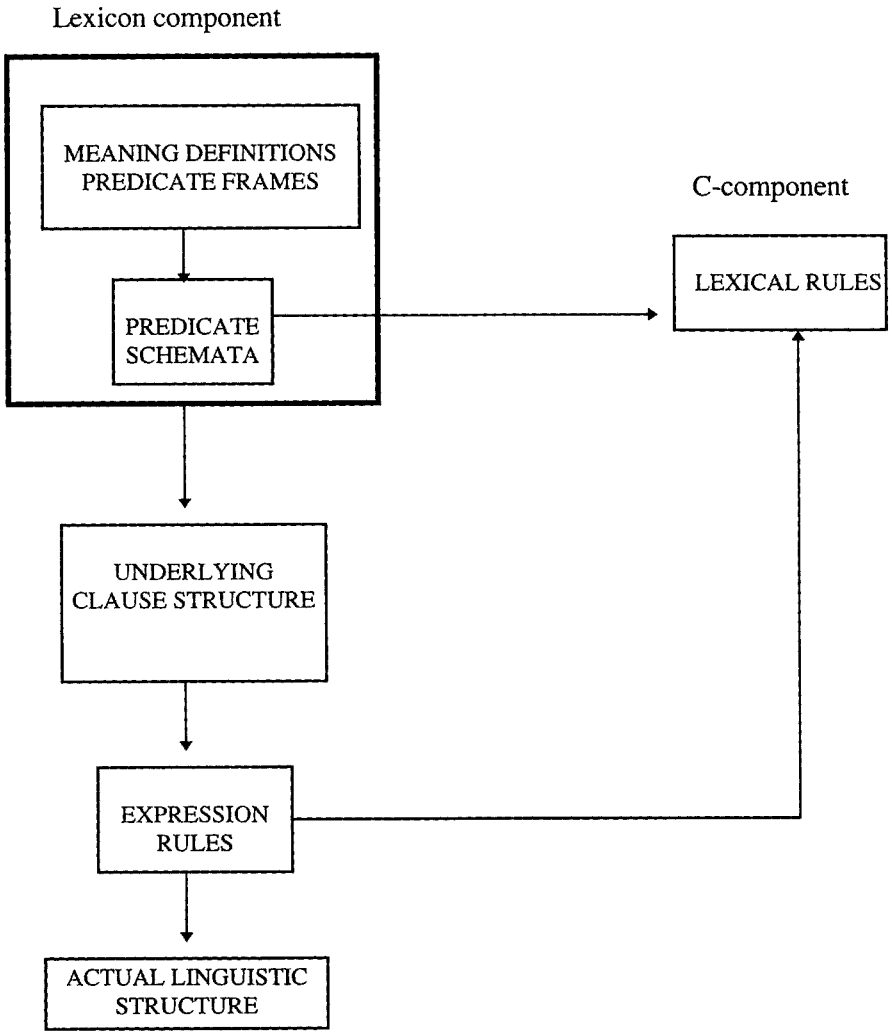
Given the fact that a set of syntactic, semantic and pragmatic factors are common to a large number of predicates with similar meaning, what was previously classified as unpredictable information is no longer so when viewed within the wider context of a semantic domain. This means that some kind of local productivity is found within a lexical domain. With the codification of such regularities within each domain, expression rules can be dramatically simplified and their number greatly reduced. In fact, the set of expression rules relevant to each semantic domain become lexical rules that define and shape a lexical domain-bound grammar

In our proposal, linking algorithms no longer operate over single predicates but over a whole dimensional predicate schema. A linking algorithm is instantiated via a set of lexical rules which in turn form what we have called the c-component (or conceptual component). This component is a kernel lexical grammar which contains those semantic, syntactic and semantic rules common to a set of lexemes.

Expression rules are thus lexically governed and more particularly lexically field-bound. This *a priori* seems to go against Dik's (1989: 293) statement that «each rule must be capable of being formulated without mention of the specific lexical items to which it may be applied». However, the operandum of these rules, as shown below, will be either a lexical domain or a lexical subdomain and accordingly no specific lexical predicates will be used. In relating rules to specific cognitive schemata the grammar, and more particularly the lexicon, become more realistic and dynamic. Rather than being a list of irregularities, the information encoded in the lexicon is in the majority of cases able to be systematized in the same way as a grammar.

From this, it naturally follows that expression rules feed directly upon the information contained in the lexicon under the form of predicate schemata. This results in the following:

(10) TOWARDS A NEW DERIVATIONAL SCHEME IN FG



As diagram (10) shows, the c-component feeds upon the information provided by predicate schemata. The principal function of this component is the storage of the linguistic information provided by predicate schemata in terms of a set of lexical rules which will directly constrain the number and type of expression rules.

The lexicon component consists of meaning definitions and predicate frames on the basis of which predicate schemata are derived, and accordingly, the productive information provided by predicate schemata is in turn formalized in terms of lexical rules. In this way, predicate schemata serve as input for the construction of the underlying clause structure.

Lexical rules are thus conceived as parametrization procedures of the linguistic regularities found in each of the semantic domains of the English verbal lexicon. The full set of lexical rules relevant to each semantic domain will constitute a nuclear lexical functional grammar and using predicate schemata as input, a typology of lexical rules relevant to each semantic domain can be elaborated.

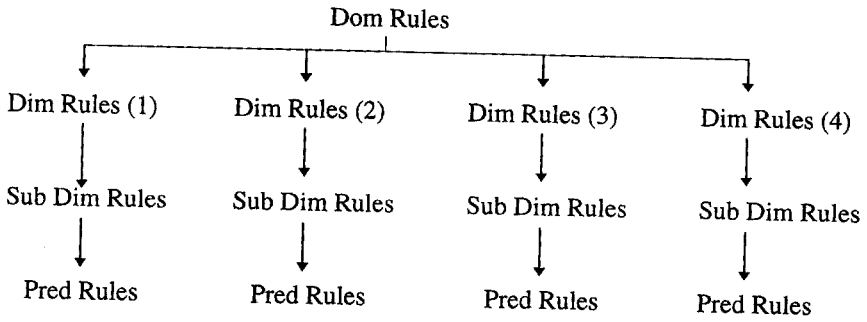
3.2. The form of Lexical Rules

Each predicate schema triggers a set of morphosyntactic principles which encapsulate all the information common to the predicates under one dimensional predicate schema. The format of these rules is similar to that of expression rules:

(11) Operator [operandum] = value

There are lexical rules affecting each of the predicates, rules for each dimension, and also rules that operate within an entire lexical domain. For the construction of a Lexically-Bound Grammar, those rules that affect a dimensional schema will be used as the basic units of analysis. The inventory of lexical rules reflect the three major structuring units in the FL Lexicon and thus consist of three different types:

(12)



LexDom rules[4] operate over a whole lexical domain and have the following format:

(13) Dom Operators [LexDom] = Dimension schemata

More specifically, the operandum comes under the form of a given lexical domain which is modified by an operator. For example, the CAUSE operator will activate the causative dimensions in a given field:

(14) Cause [cognition] = *to cause sb to learn*
to cause sth to be known
to cause sb to understand sth
to cause sth to be understood better
to cause sb not to understand / understand with difficulty

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[4] For a complete description of these rules see Mairal (1997).

LexDim rules are of utmost importance in the construction of a Lexically-Bound Grammar since they contain relevant information for all of the predicates in the dimension. Such rules have the following format:

(15) Dim operators [Dim-n ε XLEX DOM] = predicate / s $_{\text{Dim-n εXLex Dom}}$

Each rule has a dimensional operator which modifies a given dimension and triggers a set of predicate / s which belong to that dimension, and are in turn characterized by that operator. The following example is from the domain of EXISTENCE:

(16) INCH [DIM-3 ε EXISTENCE] = *begin*
commence
start

The information provided by the predicate schema serves as input for the formulation of Dim Rules which specify the following types of information:

(a) type of syntactic construction (transitive, intransitive, ergative, unergative, ditransitive etc.)
(b) semantic functions of the arguments
(c) selection restrictions of the different arguments
(d) morphosyntactic realization of the underlying clause structure operators ((operators)

For example, Dim rules specifying the type of syntactic construction would be encoded as shown below:

(17) **RULE 1**

(R1) Syntactic Construction [Dim-X] = quantitative valency and SoAs

When a certain syntactic construction modifies a given dimension, it results in a specific set of values, e.g. quantitative valency and state of affairs.

Predicate rules are a subset of Dim Rules. Their function is to actually select the predicate under analysis. The operators of predicate rules come under the form of a multiple set of operators which mark the linguistic properties of a given predicate.

In sum, three major types of lexical rules will be used: Lexical Domain Rules, Dimensional (or Lexical subdomain Rules), and Predicate Rules, which are themselves integral members of Dim Rules.

4. CONCLUSIONS

On the FLM cognitive axis, syntactic and paradigmatic regularities converge in the codification of predicate schemata. In this sense, a lexicon organized in terms of predicate schemata offers a new perspective on the development of linking regularities because these regularities can be encoded in terms of a set of rules which ultimately give shape to what we have called a Field-Bound Lexical Functional Grammar. The cognitive axis postulated within the framework of the FLM also has important consequences for Simon Dik's Functional Grammar principally because it brings meaning definitions to the forefront and significantly simplifies expression rules.

In this respect, the FLM is undoubtedly one of the most coherent proposals for the organization of the lexicon component. Its scientific rigor, methodological coherence, precision in the formulation of rules, and open-ended nature has given it an important place in the international linguistic forum. Let this article be our modest tribute to a great man whose teachings we were fortunate enough to receive and whose academic life we were fortunate enough to share, our beloved Professor and *magister*, Leocadio Martín Mingorance.

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