THE ROLE OF IMAGERY IN SPECIALIZED COMMUNICATION[1]

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1. Introduction

The role of metaphor has been much studied in literature, and somewhat more recently, in everyday communication within the framework of Cognitive Linguistics at every level of language (Lakoff & Johnson 1980; Lakoff 1987; Lakoff & Turner 1989; Langacker 1995; Nunberg 1995; Fauconnier & Turner 1994, 1996; Turner & Fauconnier 1995). Metaphor is a powerful cognitive mechanism that triggers both lexical and textual creativity. No longer considered to be an exclusively literary phenomenon, it is now regarded as an integral component of our cognition which shapes our understanding of the world. Not only does metaphor creatively expand the way the world is perceived and construed, it also makes it possible to access less evident areas of experience via perceptually salient conceptual domains.

According to Goldberg (1998: 214), a way in which the constructional meaning of concepts can be extended is through the use of systematic general metaphors. This is one of the reasons why overall conceptualization evoked by a complex linguistic expression is never the sum of the meanings of its lexical and grammatical components, but also depends on its construal (i.e. our capacity for conceptualizing the same situation in different ways).

> "As an inherent aspect of their conventional semantic value, linguistic elements impose a particular construal on the convent they evoke, and speakers adopt it for purposes of linguistic expression" (Langacker 1998: 4).

Within Cognitive Linguistics, metaphor is a dimension of construal since it reflects a very general ability to conceive of and structure one entity against the background of another. In this article we examine the presence of metaphor in scientific communication at the level of conceptual domain, term, proposition, and text. The results are based on extensive corpus analysis[2].

2. Metaphor in specialized communication

Since metaphor is a basic part of linguistic creativity, it can be found in specialized language texts as well as those in general language. Regarding the domain of medical oncology, an often mentioned example is the basic conceptual metaphor CANCER IS WAR, which shows the extent to which metaphors of armed conflict are used to talk about the fight against cancer or disease in general. (Stambuk 1998; van Rijn-van Tongeren 1997). This particular metaphor is so often cited that people tend to forget that it is not the only one found in oncology texts. There are many other metaphors in medical language at all textual levels.

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[2] As part of the OncoTerm research Project, our research team compiled both a parallel and comparable corpus of medical texts of approximately 32 million words in both English and Spanish on the specialized domain of oncology, including medical encyclopaedias, textbooks, and medical publications in CD-ROM as well as a variety of scanned texts, specifically chosen for their vocabulary. For a more detailed description of the methodology, see Faber, Lopez & Tercedor (2001) and Faber & Jimenez (2002). Since time and space naturally preclude presenting all of the results obtained, each section only shows the most representative examples of the analysis.

2.1. Data extraction and analysis

In this article we have used concordances extracted by means of *WordSmith Tools* to examine the metaphors present in oncology texts. Judgments of prototypicality and degrees of metaphorical extension were made on the basis of comparing concordances extracted from the OncoTerm specialized medical language corpus with those from the British National Corpus in reference to the same term. We believe that this is an improvement over other similar studies because the corpus data provides an empirical basis for our assertions, and better underlines the pervasiveness of metaphor in scientific communication. It also permits us to go beyond the phraseological level and consider other levels of the text as well as conceptual structure in general.

Corpus analysis shows that imagery is pervasive in technical and scientific texts, and plays an important role at levels of the text, such as the following:

(1) Conceptual domain level: category members in interrelated conceptual domains acquire the prototypical characteristics of the role they play in the event.
(2) Terminographic meaning: new terminological and phraseological units are often created through metaphorical extension.
(3) Propositional meaning: predicates in scientific and technical texts can generate frames which include arguments with specific selection restrictions or semantic characteristics. This in turn activates specific parameters of meaning.
(4) Pragmatic context: metaphor also appears at a more generic level and activates a specific type of construal.

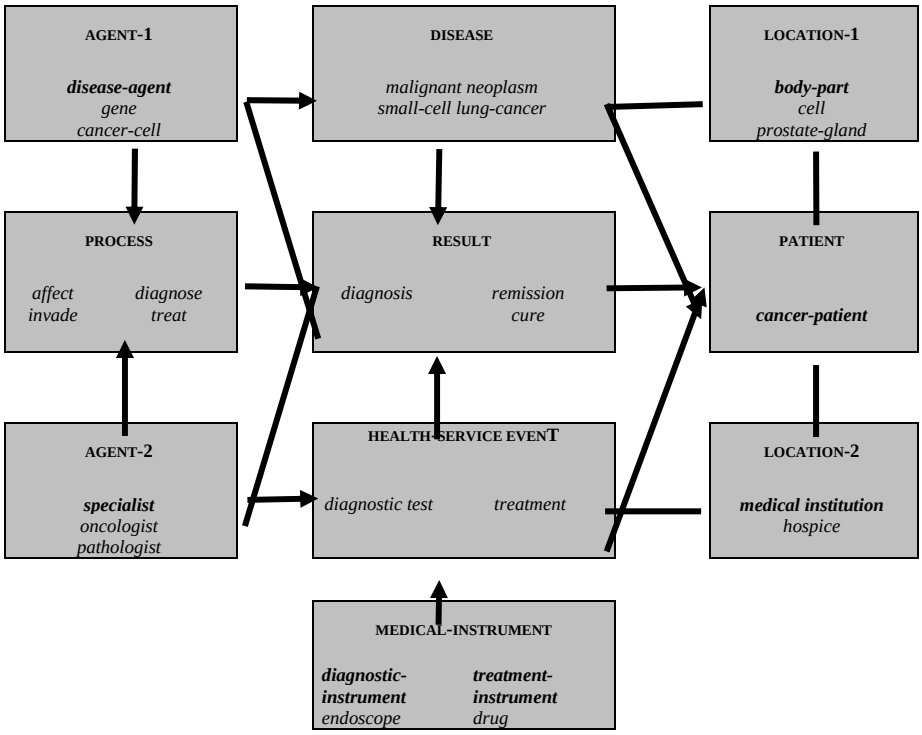
3. Levels of analysis

3.1. Conceptual domain level

Perhaps the most general level is at the paradigmatic level of semantic field or conceptual domain. This level of metaphorization is implicit in technical and scientific texts in much the same way as it is present in all general language texts.

The entities and processes in medical texts all represent conceptual categories. Some of these categories form a network in which two possible types of agents (DISEASE-AGENT, TREATMENT-AGENT) initiate processes (DISEASE, HEALTH-SERVICE EVENT), the results of which affect patients in/at a specific location.

(1) Medical Event (Faber 2002: 8)



Since Agents are prototypically animate, any entity classified as an agent acquires prototypically human characteristics.

For example, oncology texts basically focus on cells. Depending on whether the cells are malignant or healthy, they may take the role of agent or patient. Since these are conceptual roles generally ascribed to animate entities, this in itself is conducive to personification. Consequently, at different levels, cells acquire human roles as well as the prototypical characteristics of these roles. This is particularly true of *genes,* which can have general conceptual roles such as *effector, activator,* or *receptor.*

effector

(2) the identification of an **effector** g**e**ne, the Beta3-tubulin gene, as a direct target

activator

(3) The anthrax toxin **activator gene** atxA is associated with CO2-enhanced non-

receptor

(4) T-cells transduced with a chimeric **receptor gene** against human ovarian cancer

However, this personification is intensified to an even greater degree when they acquire roles that are metaphorical extensions of occupations within our social structure, such as the following:

reporter

(5) estrogen-responsive promoter linked to a **reporter gene** were evaluated for

gatekeeper

(6) A **gatekeeper gene** is one whose inactivation is necessary to allow cancer cells

weaver

(7) calcium-dependent mechanisms mediate the action of the **weaver gene** and that

transporter

(8) region of the serotonin **transporter gene** consists of three alleles, containing

Not only do cells and genes acquire social and conceptual roles, but interdomain mapping licenses them to project themselves onto other domains, and to acquire human qualities and states typical of the domain of EMOTION. This is particularly true in reference to negatively evaluated states. For example, they can be *fussy*

(9) the stem cells are immature, making them less immunologically **fussy** than

or enter a *state of crisis*

(10) was detectable. Cells which survived **crisis** had activated telomerase and had

or *distress*

(11) marker of islet cell **distress** or compromised insulin secretion, is associated

The conceptualization of cells as animate entities also projects them into the domain of MOVEMENT, where they are licensed to engage in typically human types of movement. As a result, they can *migrate,*

(12) when postmitotic ganglion cells are **migrating** away from the cochlear anlage.

crawl

(13) calcium both in suspended cells and in **crawling** cells. Calcium release is a

or *wander* to participate in acts of reconnaissance *(scout)*

(14) Lymph nodes are where **wandering** T-cells **scout** for target substances

The animacy acquired as the result of metaphorical projection also causes them to participate in the lexical domain of EXISTENCE. Since cells are conceptualized as living entities, they naturally have an existence, which can be prolonged or terminated. They may be considered *immortal*

(15)marker to detect the existence of **immortal** lung cancer cells in clinical

or *starve*

(16) move as large swarms. However, when **starved**, cells aggregate into fruiting

or even *commit suicide.*

(17) damaged cells, cancerous or not, commit **suicide**. This is called programmed

This extended type of projection is made possible because of the interrelations between the domains of EMOTION, MOVEMENT, and EXISTENCE.

3.2. Terminological level

Still another level where metaphor can be found is at the most basic level of the term. The lexicon, whether general or terminological, is the set of fixed expressions in a language, regardless of their size or type. In many ways, specialized language is an extension of general language.

Many terms have been created because of a perceived similarity in shape, size, activity, etc. to some aspect of the immediate context of the perceiver/conceptualizer. This confers a specific type of construal of the entity being categorized. The analysis of related groups of terms points to the general contextual features that are activated in terminological creation.

For example, terms in (18) point to the conceptualization of the human body as an agricultural field or surface, where crops are cultivated with tools, and where the doctor/health professional is conceived as the farmer. Most of the metaphorical extensions below are based on perceived similarity of shape or function.

(18) THE HUMAN BODY IS AN AGRICULTURAL SURFACE

AGRICULTURAL ACTIVITIES

- *bone-marrow **harvest***
  (19) prior to chemoablation, patients undergo **bone marrow harvest**,
- *bone marrow **transplant***
  (20) patients who have received a **bone marrow transplant** from a related donor
- *iridium **implant***
  (21) inadequacy of **iridium implant** as sole radiation treatment for operable
- *bone marrow **graft***
  (22) We replaced the **bone marrow graft** with repeated injections of TNF-alpha
- *tumor **seeding***
  (23) We believe that **tumor seeding** to the chest wall occurred at the time of

AGRICULTURAL TOOLS

- ***sickle** cell*
  (24) which was not observed in light **sickle cell** membranes nor in normal cell

AGRICULTURAL CROPS

- ***oat** cell carcinoma*
  (25) our knowledge, **oat cell carcinoma** of the tongue has not previously been

PLANT PARTS

- *radiation **seeds***
  (26) prostatectomy, external beam radiation, implanted **radiation seeds**, and
- ***stem** cell*

(27) chemotherapy in addition to peripheral **stem cell** transplantation and

- *dorsal **root** ganglion cell*

(28) for sensory neurons. L4 **dorsal root ganglion cell** counts revealed that

- ***petal** senescence-related gene*

(29) structure of PACO1, a **petal senescence-related gene** from Phalaenopsis

In contrast, the group of terms in (30) is a related set which also shows how the human body is regarded as a geographical surface, but this time the focus is primarily on areas of liquid movement and subterranean locations.

(30) THE HUMAN BODY IS A GEOGRAPHIC SURFACE

- *vascular **lake***

(31) vessels termed **vascular lakes** dominated the complex microvascular

- *vascular **waterfall***

(32) a **vascular waterfall** in the venous compartment was identified as the

- *metastatic **cascade***

(33) role of adhesion molecules along **metastatic cascade** as well as their

- ***cavern***

(34) the place of the forming **caverns.** These results show significant initial

- *carpal **tunnel***

(35) the **carpal tunnel** was smaller in CTS patients than in healthy volunteers

- *ciliary **valley***

(36) after running completely through the **ciliary valleys** in close contact

This type of metaphor can also be based on perceived similarity of shape between everyday objects (hairpin, spindle, signet ring, etc.) and the scientific entity in question (structure or cell). Construal here depends on objects in the immediate context.

(37) EVERYDAY ARTIFACTS

- ***hairpin** structure*

(38) peptide to one face of an **RNA hairpin** organizes the other, which in turn

- ***signet-ring** cell*

(39) intracytoplasmic vacuoles similar to those in **signet-ring cells** were

- ***goblet** cell*

(40) proteins expressed by **goblet cells** that are secreted onto the apical

- *DNA **ladders***

(41) as measured by the formation of typical **DNA ladders** and of typical cellular

- ***dumbbell** DNA molecules*

(42) the ability of linear **dumbbell DNA** to transform E coli suggests that

(43) BODY PARTS ARE BUILDING STRUCTURES

- *cell walls*

(44) gain insight into the biosynthesis of **cell wall** material, and clone cell

- ***palisade** cells*

(45) a reduced dry weight and a decreased number of **palisade cells** in the leaves

- ***duplex** DNA*

(46) thermodynamically more stable than **duplex DNA** and many guanine-rich

- *DNA **library***

(47) from a complementary **DNA library** constructed from the rat facial nucleus

The choice of domains derived from immediate context is not random. In the same way as general language reflects the way that we impose the structure of our bodies on object us (e.g. *arms* of a chair,

legs of a table), medical language reflects how we also map the structure of the world onto our bodies or even consider our bodies as a world in themselves.

3.3. Propositional level

Metaphorical extension also affects propositional meaning, given that the arguments of a semantic predicate will have different selection restrictions, depending on the area of meaning the predicate belongs to. The degree of abstraction of the arguments of a predicate is the result of its metaphorization and the consequent extension of its meaning to other domains.

Terminological studies normally focus on object concepts, which in most cases are linguistically represented by nominal forms. However, both in the comprehension and structure of specialized discourse, verbs play an important role. As semantic predicates, verbs generally determine the overall form and meaning of sentences, which are the linguistic representation of one or various propositions. Goldberg (1998: 205) calls basic linguistic representations *constructions*, and proposes the following hypothesis:

> **Scene-encoding hypothesis**: Constructions that correspond to basic simple sentence types encode as their central senses, event types that are basic to human experience.

She argues that such constructions serve to carve up the world into discretely classified event types. This is in line with Langacker (1991: 294-295) who affirms that language in general is structured around certain conceptual archetypes.

One of the ways in which such events can be extended is through the use of systematic general metaphors. A whole host of expressions and event types can be derived from metaphorical extensions of a verb's basic meaning. As shall be seen, many of them are systematic and specific to their use in a specialized domain. This type of metaphorical extension is not so evident in the grammatical construction itself as in the semantic characteristics of the arguments. In this respect, the degree of technicality of the text can also constrain the meaning of the predicate as well as the type of arguments that it can take.

Specialized medical texts have clearly established preferences for verbs belonging to specific lexical domains. The most frequent verbs in our corpus are those belonging to the domains of PERCEPTION (MENTAL and VISUAL), CHANGE OF STATE, and POSSESSION [subdomain of MANIPULATION].

This is only natural if we take into account the principal objectives of medical research articles, which are to prove or disprove a hypothesis, describe the study carried out, and present the results obtained. There is a statement of a specific problem, a description of the research carried out, a discussion of the results, and a conclusion. This repetition of textual macrostructure is conducive to a certain restriction of the meaning of the lexical items in the text.

In the description of a research event within a medical context certain predicates are activated more frequently than others. The semantic parameters of their arguments contribute to constrain the meaning of the predicate and limit the possibility of polysemy. In general communication such verbs are often highly polysemic, their multiple related meaning being the result of metaphorical extension. It is often the case that in specialized texts, the meaning of such predicates is restricted to one meaning, generally the one where the semantic arguments are the most abstract.

For example, a verb that frequently appears in our corpus is *implicate* within the domain of CAUSATIVE VISUAL/MENTAL PERCEPTION. . It can have the following meanings in general language discourse:

(48) *Implicate:* general language meaning

IMPLICATE	
Longman Dictionary of Language and Culture	to show that (someone else) is also concerned (in an esp, criminal activity).

Although *implicate* can also be used to signify *imply*, its principal meaning is the above. This is evident in the following sample of concordances extracted from the BNC:

(49)	ed by the suspect or evidence **implicating** anyone in the crime
(50)	embers of the security forces **implicated** in the torture and
(51)	those letters which totally **implicated** her in the murder,

As can be seen, persons, data or evidence can be the agent/instrument that implicates a human entity in an extremely negative event such as *crime, torture, murder,* etc.

In specialized medical discourse, *implicate* is used very frequently[3], but not to refer to either a person or involvement in a criminal activity. In the following concordances extracted from our corpus, evidence/reports/data implicate a body part/activity in a disease or disease-related event.

(52) at integrins have been **implicated** in neoplasia and tumor progression
(53) motoneuron death has been **implicated** in the neurodegenerative disease
(54) cancer and AIDS, and is **implicated** in a variety of ocular diseases

As the preceding concordances show, in general language and specialized texts, the verb structures the discourse since it determines the number of arguments in each proposition as well as their semantic characteristics and function. In this sense, *implicate* can be said to have three arguments.

(55) Basic proposition

	Predicate	**1st Argument**	**2nd Argument**	**3rd Argument**
General Language	IMPLICATE	evidence	human	crime/negative activity
Medical Language	IMPLICATE	evidence/data	body part/ symptom	disease/negative condition

The general language meaning of *implicate* is mapped onto its use in specialized texts, and this effects the semantic parameters of the arguments. Body parts and symptoms acquire human characteristics. Disease thus becomes conceptualized as a criminal activity. This gives rise to the conceptual metaphor DISEASE IS A CRIME.

3.4. Textual level

Imagery in texts can also activate larger memory organization packets in lexical domains, thus enabling the text receiver to process the information in the text from a specific perspective. Metaphors occurring at the level of text can thus be a mechanism which structures an entire discourse of set of discourses.

As previously mentioned, the frequently cited arm conflict metaphor is not the only one in medicine, nor is it necessarily the most important, especially in highly specialized research articles. A more frequent metaphor in this type of discourse is the police investigation metaphor. In this case the doctor is the police detective who, like Claude Raines in *Casablanca*, rounds up the usual suspects. This kind of sleuthing activity activates the *police investigation* frame as well as a subsequent *courtroom* frame within the context of which the culprit is brought to trial.

The police investigation frame has four entities: (1) detective (doctor); (2) culprit (disease); (3) evidence (data); (4) conviction (diagnosis). The predicates within the frame, principally those belonging to MENTAL PERCEPTION, configure these entities into meaningful relationships. The detective has the role of agent/experiencer whose general task is to solve a *mystery*.

(56) I; Foss HD TI - [Hodgkin's disease: a **mystery** is being solved] SO

Within the frame activated by related linguistic representations, the doctor becomes the *detective*/*sleuth* who must solve it.

(57) Two new **detective** methods were reported, one is
(58) EDITORIAL Molecular **Sleuthing**: Tracking Ovarian Cancer Progr

The problem is detected, and on the basis of *clues*, such as *footprints,* the detective looks for the culprit.

(59) abnormalities may provide a crucial **clue** to the understanding of the develop
(60) unambiguously, the results of chemical **footprinting** can be explained in terms

He finds a *suspect*, who is put under *surveillance.*

(61) and marrow. A physician may **suspect** hairy cell leukemia after perfo
(62) well-being and breast cancer **surveillance** and prevention behaviors.

Evidence is gathered and examined.

(63) tumor samples, providing **circumstantial evidence** for the location

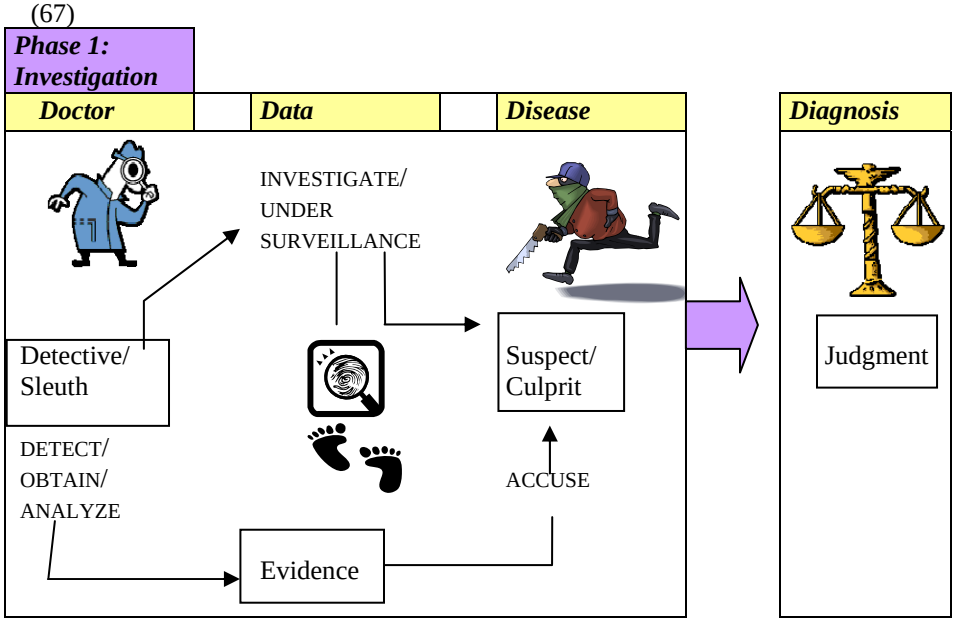
If sufficient evidence is found, the *culprit* is then *accused* and brought to trial.

(64) angiography showed regression of the **culprit** coronary lesion to

(65) bromocriptine) have also been **accused** of giving cerebral postpartum an

The frame involved is represented in (67).

(67)



However, in the second phase the doctor changes roles. He is no longer a detective, but a lawyer who *interrogates* the witness (affected body-part) by means of a diagnostic instrument.

(68) n of abnormalities involving the vessel **interrogated**, or detection of

The *testimony* of the witness many or many not *implicate* the accused.

(69) ctioned human gene therapy trial offers **testimony** to the safeguards in
(70) Kaluga Province (3.1%). These data can **testify** about the role of inside

(71) virus (LCMV), the prototype arenavirus, **implicate** oral and intragastric

After the testimony of the witnesses and the presentation of *evidence*

(72) A evidence that indicates the amount of **incriminating evidence** needed in

a *verdict* is emitted by the jury.

[3] In the OncoTerm corpus *implicate** generated a total of 1813 concordances.

(73)	ealth, wrote in a editorial that the **verdict** on DDT is still out. "We will ev

(74)	lae as it is for acute reocclusion. The **jury** is still out on whether antiprolife

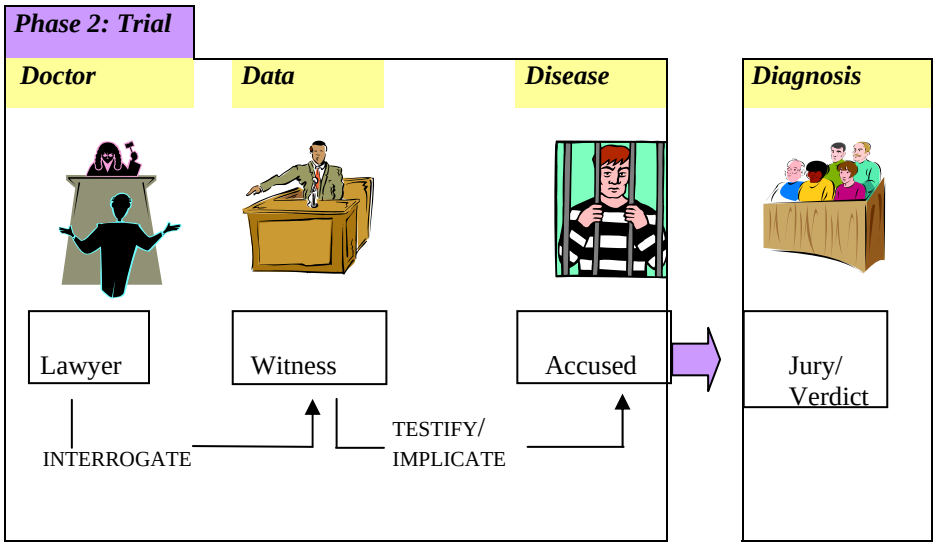
The accused many be *exonerated*

(75)	ual numbers of reports implicate it and **exonerate** it as a pathogen. Gen

or declared to be the culprit and *incriminated.*

(76)	ted drugs and chemical agents have been **incriminated** as causes of aplastic

(77)



This type of metaphor is more complex because it is based on social structures rather than basic perceptual experience. However, what licenses the whole frame is the fact that inanimate entities such as germs, cells, antibodies, etc. are conceptualized as animate ones.

4. Conclusion

According to Langacker (1998:1), since metaphor is part of our basic perceptual experience, it should be analyzed in terms of cognitive systems and abilities. In this sense, metaphorization can be regarded as an important means of linguistic creativity since it involves understanding and defining one concept in terms of another. This entails the construction of meaning.

Concepts cannot exist by themselves, but must necessarily be conceived as being related in some way to others in the same conceptual area. Although this type of semantic network is based on a multiplicity of conceptual relations, the skeleton of category structure is hierarchical because this is what is reflected in language.

Metaphor is one of the most important ways that categories are interrelated. This type of construal is present in both general language and specialized language texts, and is dependent upon a body of domain knowledge already organized and dependent on other more basic concepts.

Through corpus analysis we offer representative concordances which underline the multi-level nature of metaphor at the levels of domain, term, proposition, and text. These examples give ample proof that metaphor in scientific texts is a much more complex and pervasive phenomenon than is generally believed.

5. References

Faber, Pamela (2002). “Investigar en terminología”. In Faber, Pamela & Catalina Jiménez Hurtado. *Investigar en Terminología*, Granada: Comares. 3-24.

Faber, Pamela, Clara Inés López Rodríguez, & María Isabel Tercedor Sánchez. (2001). "Utilización de técnicas de corpus en la representación del conocimiento médico". *Terminology* 7 (2), 167-198.

Fauconnier, G. & Mark Turner (1996). "Blending as a central process of grammar". In A. Goldberg (ed.), *Conceptual Structure, Discourse and Langua*ge. Stanford: CSLI Publications. 113-130

Goldberg, A. (1998). "Patterns of experience in patterns of language". In Tomasello (ed.), *The New Psychology of Language. Cognitive and Functional Approaches to Language Structure*. Mahwah NJ/London: Erlbaum. 203-220.

Lakoff, George & Mark Johnson (1980). *Metaphors We Live By*. Chicago: University of Chicago Press.

Lakoff, George & Mark Turner (1989). *More than Cool Reason. A Field Guide to Poetic Metaphor*. Chicago/London: University of Chicago Press.

Lakoff, George (1987). *Women, Fire, and Dangerous Things*. Chicago: University of Chicago Press.

Langacker, Ronald (1991). *Concept, Image and Symbol. The Cognitive Basis of Grammar*. Berlin: Mouton.

Langacker, Ronald (1995). "Raising and transparency". *Language* 71, 1-62.

Langacker, Ronald (1998). "Conceptualization, symbolization, and grammar". In Tomasello (ed.), *The New Psychology of Language. Cognitive and Functional Approaches to Language Structure*. Mahwah NJ/London: Erlbaum. 1-39.

Márquez Linares, C. F. (2002) "Polisemia, vaguedad referencial y terminología". In Faber & Jiménez Hurtado (eds.), *Investigar en Terminología*, Granada: Comares. 215-226.

Nunberg, G. (1995). "Transfers of meaning". *Journal of Semantics* 12, 109-132.

Rijn-van Tongeren, Geraldine, W. van (1997). *Metaphors in Medical Texts.* Amsterdam/Atlanta GA: Rodopi.

Stambuk, Anuska (1998). "Metaphor in scientific communication". *META XLIII 3*, 1-7.

Turner, Mark & G. Fauconnier (1995). "Conceptual integration and formal expression". *Metaphor and Symbolic Activity* 10, 183-204.

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