Conceptual metaphor types in oncology: Cognitive and communicative functions[1]

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Abstract

In this paper, an analysis of conceptual metaphor types and their relation with cognitive and communicative functions is carried out on a sample of oncology research papers. According to Conceptual Metaphor Theory (CMT), four conceptual types are described: imagistic, orientational, ontological and structural. The purpose is to explore the cognitive functions of metaphor – categorization and conceptualization – and their role in knowledge construction. On the other hand, communicative aspects, such as deliberate versus unconscious metaphor usage, as well as the conventional character of metaphorical expressions are observed, with the purpose of characterizing the discourse of medical science research articles in English.

Keywords: Conceptual Metaphor, cognitive function, deliberate metaphor usage, oncology.

Resumen

Tipos de metáfora conceptual en oncología: Funciones cognitivas y comunicativas

Este artículo propone un análisis de los tipos de metáfora conceptual descritos en la Teoría Conceptual de la Metáfora – imagística, orientacional, ontológica y estructural –, en relación con sus funciones cognitivas y comunicativas en el discurso de los artículos de investigación en oncología. El objetivo es explorar las funciones cognitivas de la metáfora – categorización y conceptualización – y su papel en la construcción del conocimiento. Por otra parte, se observan aspectos comunicativos, como el uso deliberado o inconsciente de la metáfora, así como el carácter convencional de las expresiones metafóricas, con el propósito de caracterizar el discurso de los artículos de investigación médica en inglés.

Palabras clave: metáfora conceptual, función cognitiva, uso metafórico deliberado, oncología.

1. Introduction

The aim of this paper is to disclose linguistic evidence of metaphor use in medical discourse, particularly in oncology, a research field dealt with regularly in numerous scientific publications. More concretely, the purpose is to analyse metaphorical language in texts on HIV-related lymphoma, written by experts and addressed to a readership of peers. Consequently, a description of the conceptual types and cognitive functions of metaphor in that register is pursued. It is assumed that metaphor plays an essential role in establishing links between our understanding of the world and scientific language (Brown, 2003). In this line, a characterization of texts on HIV-related lymphoma is pursued to shed some light on the role of metaphorical models in scientific communication.

Studies on metaphor and its influence on human knowledge have proliferated during the recent decades, not only in the field of Linguistics or Literary Studies, but also in other Social Sciences. This has revealed the potential that metaphor bestows speakers and writers in favouring a particular standpoint. Lakoff and Johnson (1980) showed that metaphorical expressions pervade language and evince the existence of conceptual models sustaining our comprehension of everyday situations. Nowadays, the pervasiveness of metaphor is widely accepted as a necessary cognitive mechanism in our comprehension of target domains. According to this view, metaphorical models provide coherence to many spheres of human culture, from economics, law, and politics, to religion, philosophy or science (see Lakoff & Johnson, 1999). The role of metaphor in science has long been pointed out as a tool for conceptualization and theory modelling (Black, 1962; Gentner & Gentner, 1983; Kuhn, 1993), and was recently the object of more extensive analysis in this line (Brown, 2003; Zeidler, 2013). As for Medicine, discourse has been described from the perspective of genre analysis (Yanoff, 1988; Salager-Meyer, 1994; Gotti & Salager-Meyer, 2006; Wilce, 2009) and terminology (Dirckx, 1983; Cimino et al., 1994). Additionally, the qualitative analysis of particular metaphors in medical discourse (Semino et al., 2004; Semino, 2008, 2011) constitutes a valuable contribution. According to Semino (2011), metaphor adapts differently to genres of diverse social scope, mainly in terms of communicative and conceptual function. Since the appearance of Illness as Metaphor (Sontag, 1978) there has been a considerable amount of research adopting a sociological perspective to deal with metaphor usage in the context of healthcare and illness, and its application to therapy and doctor-patient

communication (see Demjén & Semino, 2016 for an overview). In the context of clinical practice, Coulehan (2003) focuses on the importance of metaphorical narrative to healing processes and Masakume and Zumla (2012) discuss the cross-cultural implications of metaphor usage. On the other hand, the study of conventional metaphor usage in medical scientific discourse has revealed the relevance of metaphorical models like war, sport, the body-as-machine (Periyakoil, 2008) or personification and other models (Huang, 2005; Finatto, 2010) in the conceptualization of medical processes and notions. Additionally, systematic corpus studies have contributed to raise awareness of the pervasiveness of metaphor in technical medical texts (Mungra, 2007) and to point out communicative functions of medical metaphors in popularization media (Camus, 2009).

This paper focuses on medical language used by specialists and addressed to colleagues, with the purpose of identifying and characterizing cognitive as well as discursive functions of metaphorical language. From previous observation, our hypothesis is that the specialized register under scrutiny here – oncology research – is expected to use metaphor conventionally and unconsciously for conceptual rather than communicative functions, whereas discourse addressed to the general public – such as the press – is expected to incorporate cognitive models with an argumentative and expressive function (Navarro i Ferrando, 2016).

2. Conceptual metaphor types

Dealing with the concept of metaphor, Black remarks that a figurative form normally substitutes the literal one, though sometimes there is no literal expression at all, so that a metaphor is just "the use of a word in some new sense in order to remedy a gap in the vocabulary" (Black, 1955: 280). Subsequently, Black (1962) endorses the interaction view of metaphor, suggesting that two thoughts about different entities are active together and supported by a single linguistic expression whose meaning results from their interaction. Lakoff and Johnson (1980) and Lakoff (1993) systematized Black's (1962) interaction approach as the conceptual mapping approach. According to this view, "metaphor has come to mean a cross-domain mapping in the conceptual system" (Lakoff, 1993: 203) characterized as a set of ontological correspondences between two domains, where the implicational system of the source domain provides a model for the

conceptual relationships in the target domain. Mappings are constrained by the invariance principle that ensures the maintenance of the target domain original coherence. In turn, mappings determine epistemic correlations by projecting knowledge from the source domain onto the modelling of the target domain. In this survey, metaphors reveal how the domain of human cells is modelled partially according to knowledge configurations from other domains. For the purpose of conceptual modelling, four types of conceptual metaphor are postulated, namely imagistic, orientational, ontological and structural (Lakoff & Johnson, 1980; Lakoff, 1993). Additionally, Kövecses (to appear) has recently pointed out that the conceptual content of metaphorical mappings may be approached from different levels of abstraction (image-schemas, frames, domains, and mental spaces). Accordingly, both source and target domains participating in a metaphor are envisaged as knowledge configurations that involve pre-conceptual structure (image-schemas) together with a conceptual structure (concept, frame, domain), and consequently, the four conceptual metaphor types can be correlated with one or more levels of knowledge configuration.

The imagistic metaphor type correlates one conventional image onto another by means of similarity, and allows for mapping knowledge about the first (Source) onto knowledge of the second (Target). Conventional images are structured by both image-schemas and a category or concept at the conceptual level in the mapping given that shape is one of the attributes of basic categories in human conceptual systems. Image metaphors are very expressive because they schematically profile very concrete aspects of experience, such as particular scenes or formal qualities of single entities, as seen in example 1:

> (1) The idea of putting any form of the AIDS virus into people sounds a bit frightening, […], but the virus used by his team was 'gutted' and was no longer harmful. (Grady, 2011: 1, Sept. 13)

The expression "gutted" recalls the image of an animal that has been emptied of organs so that it can be prepared as food or, in an extended meaning, a room or building that has been emptied for redecoration. The image of a hollow space is transferred to the idea of a virus understood to be empty of its previous genetic configuration so that new genetic architecture can be implemented. The image metaphor here maps an emptied space.

Secondly, orientational metaphors configure a system of concepts on the grounds of spatial orientation (up-down, in-out, near-far). Orientational metaphors project spatial orientation onto abstract concepts, such as happiness (HAPPY IS UP, or SAD IS DOWN). The orientational configuration expressed by the metaphor is based on our experience of the world through perception and motion.

Next, ontological metaphors represent abstractions such as activities, emotions or ideas, as something concrete, such as objects, substances, containers or persons. Thus, components of experience like abstract entities, processes, events, attributes and relations are managed conceptually as concrete objects or tangible substances. Nominalization is, therefore, a basic mechanism for ontological metaphor because it expresses the properties of a thing (MIND IS A CONTAINER) or a person (DEATH IS A REAPER).

Finally, structural metaphors build the conceptual configuration of one complex concept or a whole domain in terms of another. Typically, structural metaphors grow on a set of inference patterns and implications from the source domain that facilitate understanding and provide coherence for the target domain (LIFE IS A JOURNEY).

3. Cognitive and communicative functions

In scientific texts, metaphor usually fulfils a task directly related to the contents of a theory or to the explanation of a phenomenon (Fauconnier, 1997: 165-168). When the reality that the scientist tries to describe escapes direct perception – as is the case of cells, bacteria and viruses – scientists need to make an effort to create models to conceptualize the phenomena under observation. In addition, the discovery of previously unknown facts makes it necessary to create new categories precisely to name such phenomena. Thus, science not only needs to name entities whose existence was not known (categorization function), but also elaborates new conceptualizations of previously unknown processes and complex systems (conceptualization function). Categorization, as a metaphor cognitive function, implies that a "base concept is used to access or derive an abstract metaphoric category of which it represents a prototypical member, and the target concept is then assigned to that category" (Bowdle & Gentner, 1999: 92). This function also provides a name for the target concept and serves primarily to attribute specific properties to it (Glucksberg & Keysar, 1993).

On the other hand, conceptualization, as a metaphor cognitive function, leads to the elaboration of models that explain the relationships between the entities in the target domain within a conceptual system including frames, scenarios and scripts as conceptual configurations (see Kövecses, 2015: 31-48). This analogical process includes mapping and induced schemas from the source domain, and may lead to extension and reanalysis of the target domain (Fauconnier, 1997: 102-105).

As for communicative functions, the user's intentionality – the deliberate use of metaphorical expressions – is observed. Steen (2011) suggests that a deliberate use of metaphor implies the speaker's awareness of a cross-domain mapping and an intention to alert the addressee to that mapping, which indicates a specific rhetorical motivation. The user's communicative goal points to changing the addressees' perspective on the current topic in the communicative event by making them look at it from the point of view of the source domain in the mapping. The interlocutors process the meaning of a metaphorical utterance as a comparison between the domains, being that comparison conscious if metaphor is deliberately used. Moreover, in many communicative events, the speaker's intention leads the hearer in the process of configuration of both concepts and relationships in the target domain, which reveals a conceptualization function. On the other hand, conventional metaphors normally occur in non-deliberate usage. According to Steen (2011), the meanings activated by the metaphorical expression are processed directly as meanings in the target domain, with no online mappings in the communicative act. Metaphor usage may be, then, unconscious and the metaphor usually fulfils a categorization function, since the interlocutors categorize the concepts directly in the target domain without carrying out an analogical process.

Thus, our hypothesis holds that the cognitive conceptualization function, whose objective is to elaborate models (via analogical processes), is prototypically the result of a deliberate use, while the categorization function prototypically results in the use of terminology that, being already known by the scientific community, is conventional and used unconsciously.

4. Materials and method

The aim of this survey is a qualitative analysis of metaphor types and functions in oncology research papers, controlling the three parameters of

"field", "tenor" and "mode" (Halliday, 1985/1989). For that purpose, a sample corpus consisting of 8 research papers, 1 editorial and 3 letters to the editor from specialized journals (see references in the appendix) was compiled with the assistance of the research staff at the Catalan Institute of Oncology,[2] who provided the materials. The topic (field) was limited to HIV-related lymphoma by selecting articles including two keywords: "lymphoma" and "HIV". Consequently, all the texts in the sample deal with lymphomas caused by HIV, which assures the desired homogeneity. The articles are written in a very formal style, addressed to a readership of oncologists (tenor). As a result, the corpus includes 12 articles on HIV-related lymphoma treatment, totalling 30,419 words and covering a time span from 2001 to 2016. The limited size of the corpus allows for a qualitative characterization of the data. On the other hand, given the unequal distribution of texts obtained per genre, this research focuses on analysing metaphor in a particular register, rather than on differences between genres. Furthermore, style and content traits do not differ significantly among these genres in the highly specialized journals selected. As Cameron and Deignan (2003: 151) point out, though findings may not be generalizable, small samples allow for manual analysis providing data which could be used as starting clues for searches in large corpora. Our collection of highly specialized texts was compiled with particular sociocultural criteria for this investigation and constitutes a relevant body of evidence that can be directly interpreted (Sinclair, 2001: xi).

At this point, a diagnostic criterion is necessary for identification of metaphorical expressions where an expression taken literally poses a logical contradiction in the context in which it occurs. To this end, a Metaphor Identification Procedure (Pragglejazz Group, 2007; Steen, 2007; Steen et al., 2010a & 2010b) is applied. Steen et al. (2010a: 15) suggest that "metaphor in discourse can be identified by looking for indirectly used words, which then have to be interpreted by comparison to a more basic sense". Thus, the method is grounded on the comparison of contextual meaning with primary meaning for a set of selected lexical units. Primary meaning is determined by basic definitions in *Cambridge English Dictionary Online* (henceforth, CEDO) and *Merriam Webster Dictionary and Thesaurus Online* (henceforth, MWDTO). The contextual meaning is determined by the frame configured by those concepts expressed through lexical units appearing in combination with the selected lexical unit. The comparison of the basic meaning frame elements with the contextual meaning frame elements determines whether the frames

are the same or if they differ. Metaphors are identified in those cases where basic and contextual frames differ. Once metaphorical expressions have been identified, the metaphors are classified into four conceptual types, namely imagistic, orientational, ontological and structural, as described in section 2. Each one of these types correlates with the conceptualization or categorization function described above. A metaphor fulfils a conceptualization function when it helps both speaker and hearer in understanding and characterizing the cognitive domain that constitutes the topic of discourse, the relationships among the concepts in that domain, its frames and scripts. On the other hand, the categorization function provides categories for entities in the target domain, as is the case when we need to refer to a particular event, process or participant.

The metaphors are then analysed as deliberate versus non-deliberate on the basis of the occurrence of linguistic or other types of marks. In order to discern which uses are deliberate and which are not, those formal signals making the author's intention apparent are observed (quotation marks, italics, special formats, or linguistic resources, such as comparisons and similes). The following signals, which constitute explicit alerts on behalf of the author, serve for the researcher to consider a metaphorical expression as deliberate metaphor usage: quotation marks; simile marked by "like" or "as if"; analogy (let us think of X as Y, in the same way as X so Y, etc.); mental space builders (imagine X, think of X); X-of-Y nominal construction; and X-is-Y construction.

Finally, metaphors are marked as conventional versus novel. A metaphor is considered to be conventional if the contextual meaning, defined by the contextual frame, corresponds with a secondary meaning in CEDO or MWDTO, or both, and differs from the primary basic meaning that represents the source domain of the metaphor. This is clear evidence that the particular sense is lexicalized, and consequently, conventional in the discourse community.

For the purposes of our analysis, attention was paid only to metaphorical language used to process information about the target domain, namely HIV-related lymphoma and the human body, the processes involved, their consequences and medical treatment. Other conventional metaphorical expressions and novel metaphorical expressions employed as stylistic devices were left out.

5. Results

Altogether, 24 lexical units (types) pertaining to the field "oncology" were found to be used metaphorically in the entire corpus, totalling 351 tokens (1.15% out of 30,419 words). The results showing conceptual metaphor types and their cognitive functions are presented in separate sections, 5.1 and 5.2, respectively. With regard to the communicative aspects of metaphor usage, deliberate metaphor usage – an intentional phenomenon – is apparent to the researcher as far as signals occur in the discourse. The intention was to find evidence of deliberate uses of metaphorical expressions. However, none of the expected marks (see section 4) were found in the corpus (the implications of these results are discussed in section 6). Finally, section 5.3 presents results concerning the conventional character of metaphor usage.

5.1. Conceptual metaphor types

Table 1 shows the four types of conceptual metaphor and the linguistic expressions corresponding to each type. The figure in brackets by each expression indicates its absolute frequency (number of tokens) in the entire corpus.

imagistic	orientational	ontological	structural
bulky(3)	follow-up(29)	cohort(26)	severe(13)
effusion(3)		cross-talk(9)	dominant(3)
diffuse(11)		stem-cell(4)	aggressive(37)
		naïve(3)	opportunistic(18)
		burden(10)	response(54)
		load (33)	noninvasive (1)
		chain(45)	colony(3)
		niche(8)	population(15)
		event(3)	migrator (1)
			site(9)
			homing(10)

Table 1. Linguistic expression of conceptual metaphor types.

In the case of imagistic, orientational and ontological metaphors, each linguistic expression corresponds to a metaphor, and the expression itself is

employed to name the metaphor in those cases where there is no additional or different term in the target domain there is "a gap in the vocabulary" (Black, 1955: 280). On the other hand, each structural metaphor is manifest in the corpus through several linguistic realizations. The standard notation in CMT for structural metaphors utilizes the formula X-IS-Y, being X the target domain and Y the source domain (Lakoff, 1993).

5.1.1. Image metaphors

Image metaphors establish a correspondence between source and target domain based on shape or visual configuration similarities. The three image metaphors identified here recall visual effects that give names to different kinds of tumour on the grounds of the visual display of the malignant cells. "Diffuse" implies a substance that is not concentrated but scattered over the place, and "effusion" implies an image of a liquid flowing out of a source. Thus, as seen in examples 2, 3, and 4, "diffuse large B-cell lymphoma (DLBCL)" and "effusion lymphoma" each specifically designates a category of tumour. In the case of "bulky disease" the expression qualifies diverse types of lymphoma or malignancy showing a larger size than could be expected.

(2) The most common ARL subtypes are diffuse large B-cell lymphomas (DLBCL). (Schommers et al., 2015: 807)

(3) […] less frequent subtypes of HIV-related lymphomas include primary central nervous system (CNS) lymphomas, primary effusion lymphomas and plasmablastic lymphomas. (Ribera & Navarro, 2008: 1129)

(4) The frequency of an intermediate-high IPI score, extranodal involvement in two or more areas, bulky disease, bone marrow, and CNS involvement and extranodal involvement were similar in both series. (Baptista et al., 2015: 813)

5.1.2. Orientational metaphors

Orientational metaphors express the understanding of a process or event in terms of spatial orientation configurations. In the case of the FOLLOW-UP metaphor, the control that doctors maintain over patients is understood via the conceptualization of a physical process whereby the patient would be (in the source domain) physically followed very closely so that contact is preserved. That control is linguistically referred to as "follow-up", a noun designating either every single event where doctor and

patient meet or the period of time over which a series of meetings take place, plus "follow up", a verb designating the doctor's control action. The semantic connotation of contact, meaning closeness, is manifested through the spatial particle "up", which suggests that proximity is a hallmark of control. Accordingly, the source domain contributes a sense of motion (the literal meaning of "follow") and an orientational clue to proximity and completed contact ("up"). Altogether, the target domain – doctors controlling treatment – is metaphorically expressed as doctors following the patient's disease at a very short distance: "follow-up" implies closeness in example (5) as verb plus noun (single event), (6) as noun (period of time), and (7) where the contextual frame also reminds of the source domain by means of the lexical unit "reachable", since patients are "lost" if no longer "reachable".

(5) Patients who were lost to follow up were censored at the time of their last follow-up […]. (Barta et al., 2016: 1)

(6) After a median follow-up of 48 months, 69% of patients (n¼33) had died. (Castillo et al., 2012: 5274)

(7) Patients were followed every 6 months and were considered lost to follow up if no longer reachable. (Schommers et al., 2015: 807)

5.1.3. Ontological metaphors

Ontological metaphors provide concepts for entities, events or processes in abstract or new domains on the grounds of semantic attributes taken from other concepts that are well and long established in the language. Rather than visual imagistic patterns or shapes (image metaphors) or spatial configurations (orientational metaphors), ontological metaphors project functional attributes onto target domains. In the case of the COHORT metaphor, the relevant attribute consists in keeping a group of persons together for some purpose – a group of patients who are submitted to the same treatment, as in (8), below:

(8) This study provides important real-life data on clinical outcomes in a large cohort of patients with ARL. (Schommers et al., 2015: 809)

Patients are characterized through the NAÏVE metaphor if submitted to a particular treatment for the first time, as in (9):

(9) We performed a case-control study nested within the Italian cohort of naïve to antiretroviral HIV patients […]. (Bibas et al., 2012: 749)

Whereas the basic meaning of "naïve" refers to a quality of human personality describing a person who is not experienced about world affairs, in the context of medical treatment, the relevant semantic feature is the lack of experience, but only in relation to the particular treatment that the patient encounters for the first time – "antiretroviral HIV".

Another ontological metaphor gives rise to the term "stem cell", which refers to an unspecialized cell, "especially one taken from a person or animal in a very early stage of development, that can develop into any other type of cell" (CEDO). The source domain induces the frame of the main trunk of a plant developing buds and shoots. The mapped attribute is a functional one, as in (10):

(10) [...] regimens followed by autologous stem cell transplantation have been increasingly employed in HIV infected patients. (Ribera & Navarro, 2008: 1131)

The LOAD metaphor depicts the amount of virus or bacteria forming a tumour as "load" or "burden". Though these two terms seem synonymous, our data suggest that the use of "load" is more extended to diverse contexts since "burden" is restricted to the collocation "tumour burden", whereas "load" occurs in this and other collocations. Thus, these lexical units provide the attribute "quantity of material as cause of an extra effort", so that the presence of virus is depicted as causing an additional effort to the supporting cells in their managing biological functions, which brings about negative consequences. In addition, this metaphor finds linguistic expression in contextual words that contribute to our understanding of how to deal with viruses. Accordingly, the metaphorical entailments prompt the use of contextual expressions, such as "reduced", "measured", "carried", shed", and so on, as well as characterized as "heavy", as in examples 11 and 12.

(11) […] splenic tumor load in LT__/_ recipient mice was significantly decreased. (Rehm et al., 2011: 1029)

(12) […] enlarged thymi resulting from heavy tumour load were occasionally detectable. (Rehm et al., 2011: 1023)

According to MWDTO, the meaning of "event", includes the outcome of an occurrence, as a lexicalized semantic aspect in addition to the happening itself. In the domain of cancer treatment, "event" designates any infection or malignancy appearing at any moment between diagnosis and cure or death. Thus, the ontological metaphor creates a specialized term, so that only certain types of occurrences are called "events", i.e. those that bring about disease, illness, impairment or worsening. The term "event" is applied to the outcome of an occurrence by virtue of a metonymic process. What we call here "occurrence" refers literally to the inception of the illness, which is conceptualized as its cause. In examples 13 and 14, emergence of cancer is referred to as a kind of "event", in this specialized sense.

(13) CNS relapse (CNSR) in adequately treated patients is a relatively rare event. (Barta et al., 2016: 1)

(14) ARL was the initial AIDS-defining event in 198 patients. (Schommers et al., 2015: 807)

The primary meaning of "niche" depicts a hollow space in a wall. In the NICHE metaphor, spatial emptiness is something wanted, so that a niche becomes an exclusive field, adding the connotation of safeness and comfort. A niche is metaphorically a goal to be reached. A conventional extension of that meaning refers to a location suited to a group of organisms, called an "ecological niche". Thus, in natural science the term describes the environment where a species has adapted for survival. In oncology, a virus reaches a niche as it infects the tissue or cell it can live on by means of consuming its proteins or molecules. The projected attribute can be traced from the frame used in natural sciences to the frame in oncology as in example, 15:

(15) […] CCR7-dependent lymphoma cell lodging, a process that is intimately linked with lymphoma cell access to survival niches. (Rehm et al., 2011: 1031)

The basic sense of the word cross-talk is almost synonymous with "interference" in the context of spoken communication through technological devices. In the CROSS-TALK metaphor, the main implication points to unwanted information intruding into the communication channel. In oncology, "cross-talk" is used to indicate that an external biological agent comes into contact with a cell and modifies its molecular configuration or

program by virtue of "interference" with the expected molecular biological processes. In addition, molecular interference is usually reciprocal, as seen in example 16.

(16) […] the lymphoma cells interacted with fibroblastic reticular cells in a reciprocal fashion. This cross-talk involved stimulation of the lymphotoxin β receptor. (Rehm et al., 2011: 1020)

In biochemistry, strong links among diverse components are expressed by means of the CHAIN metaphor. These components may be atoms, molecules or chemical groups. In addition, depending on the degree of power of these links and the amount of components, chemical chains may be denominated as light or heavy, as in example 17.

(17) The free light chain (FLC) assay measures the concentration in the serum of immunoglobulinkappa (j) and lambda (k) light chains that are not attached to a heavy chain. (Bibas et al., 2012: 750)

5.1.4. Structural metaphors

Ontological metaphors are useful conceptual mechanisms to name entities or processes in an abstract or new domain, so that the emerging concepts may designate single phenomena. However, the projected attributes from the source frame, and the new concepts generated thereby, do not bring about further entailments or implications beyond the single concepts themselves or their frames. Otherwise, structural metaphors express, as it were, complex mappings from rich source domains onto enriched target domains, where a set of linguistic manifestations show the implicational configuration of diverse participants in the source complex domain as they are recycled in order to give coherence to the relationships among participants and processes in the target domain. Accordingly, a structural metaphor represents a complex conception of a set of entities and their participation in multiple frames. In our sample, two sets of lexical units occur expressing the structural metaphors DISEASE IS AN ENEMY and A TUMOUR IS A GROUP OF PEOPLE.

In the metaphor DISEASE IS AN ENEMY, a set of lexical units expressing frames where two enemies are involved are transferred to frames and situations experienced in the relationship between patient and disease. Thus, the fact that an enemy is conceived as "aggressive" in its attitude implies that

we fear its causing damage on us or our surroundings. Damage may be "severe". An enemy waits for the best moment to attack and looks for the weak points showing an "opportunistic" behaviour. As the opponent receives an attack, a response or reaction is produced. One of the opponents becomes "dominant" over the other. In this fashion, the whole "story" about the two enemies is projected to the conceptualization of the relation between the disease and the patient and his/her body. In our sample, tumours "behave" in a particular way. Examples 18 to 22 illustrate diverse aspects of this metaphor:

"Severe", "severely": hard attitude of an opponent or enemy.

(18) HIV-infected patients had higher incidences of grade 3-4 mucositis and severe infectious episodes. (Ribera & Navarro, 2008: 1130)

"Aggressive", "aggressively", "aggressiveness": violent behaviour in human beings.

(19) In patients with HIV, NHL often behaves more aggressively and presents at an advanced stage. (Barta et al., 2016: 1)

"Opportunistic": enemy who waits for the opportunity to attack.

(20) The introduction of potent protease inhibitors in 1996 and their use in combination with other agents (HAART) has changed the incidence of many opportunistic infections. (Navarro et al., 2001: 912)

"Response": the opponent's reaction to an attack.

(21) The complete response (CR) rate of patients with high tumour burden was not different in HIV-infected and HIV-uninfected patients. (Baptista et al., 2015: 814)

"Dominant": the stronger fighter dominates the weaker one.

(22) […] p53 is the dominant tumour suppressor in Myc-induced lymphomagenesis. (Rehm et al., 2011: 1025)

The metaphor TUMOURS ARE PEOPLE represents a scenario where large groups of people, tribes or nations, "migrate" and "invade" territories. Oncological discourse shows a conceptualization of cell groups as

"populations" that "invade" a location in the body, and "home in" on a "site", establishing "colonies". This scenario is illustrated in examples 23 to 26:

Population: a large group people living on a territory.

(23) The Ihh-producing cell population localized within the T-cell zone. (Rehm et al., 2011: 1027)

Migratory capacity: populations move from one location to another.

(24) Lymphoma cells, derived from Wt-E-Myc mice, showed migratory capacity in vitro in response to the chemokine ligands CCL21 and CXCL12. (Rehm et al., 2011: 1023)

Colony: part of a population migrates and settles on a distant location.

(25) […] mobilization procedures including preferentially chemotherapy and granulocyte colony-stimulating factor. (Ribera & Navarro, 2008: 1131)

Site: a location for the establishment of a colony.

(26) […] mutations that disable p53 phosphorylation sites for Ser/Thr kinases. (Rehm et al., 2011: 1025)

An interesting projection in the TUMOURS ARE PEOPLE metaphor is the "infecting is homing" mapping. The attribute "able to find a home" is mapped to the target domain as applied to intrusive or inserted cells. The biological mechanism allowing a group of cells to home in on an organ is called receptor, and has to do with enzymatic interaction among cells.

(27) […] the chemokine receptor CCR7 regulates E_-Myc lymphoma homing to lymph nodes and distinctive microanatomic sites. (Rehm et al., 2011: 1020)

5.2. Cognitive functions

Metaphor usage in language works at the service of target domains comprehension. The four conceptual types described in section 5.1 perform cognitive functions to different degrees in different kinds of discourse. Table

2 shows the two cognitive functions observed: concept categorization and domain conceptualization.

	Categorization	Conceptualization
follow-up	+	
bulky disease	+	
Diffuse	+	
Effusion	+	
cross-talk	+	
Niche	+	
naïve	+	
burden/load	+	
stem cell	+	
chain	+	
event	+	
cohort	+	
colony	+	+
population	+	+
migratory		+
site		+
homing		+
dominant		+
severe		+
aggressive		+
opportunistic		+
response		+
noninvasive		+

Table 2. Cognitive function.

Those types of conceptual metaphor that project an entity onto another (image and ontological metaphors) result in new concept categories designating things, single events or processes. Otherwise, metaphors that project whole implicational systems (structural metaphors) provide tools for conceptualizing networks of relationships among things, processes and events in the target domain, resulting in the elaboration of complex scenarios.

The only orientational metaphor found in our data fulfils a categorizing function, given that the term "follow-up" designates a process, with no further implications in the conceptualization of the whole domain.

Interestingly, the expressions "colony" and "population" play both categorizing and conceptualizing functions in oncological discourse. Both designate categories of groups of cells or viruses, and as such, they elaborate concepts as categories of entities. From that point of view, they manifest ontological mappings. On the other hand, both participate in the complex configuration of the structural metaphor TUMOURS ARE PEOPLE. These categories of large cell groups help in the conceptualization of the disease as a land invasion by a large population. In that sense, we suggest that these metaphorical concepts fulfil both categorizing and conceptualizing cognitive functions.

5.3. Conventional vs. novel usage

Regarding the conventional or novel character of metaphorical expressions, our criterion relies on lexicographic information contained in CEDO and MWDTO. For each metaphorical lexical unit analysed, as far as one dictionary provides a definition for the sense found in the contextual frame in the corpus, that metaphorical sense has been considered lexicalized, and therefore conventional in the discourse community (follow-up, stem cell, naïve, severe, aggressive, opportunistic, response, colony, population, migration, chain, load). Technical denominations consisting of an acronym are considered conventional in the discourse community, such as "primary effusion lymphoma" (PEL), "diffuse large B-cell lymphoma" (DLBCL) and "free light chain" (FLC). As for the expressions "bulky", "site", "niche", "cross-talk", "homing", "dominant" and "(non)invasive", CEDO and MWDTO do not offer a specific oncological definition, but include very close definitions used in biology, which also correspond to the contextual frames in the corpus. This observation points at the conclusion that the categories expressed by these lexical units are also conventional in the field of oncology, being extensions of the senses defined in CEDO and MWDTO. Since specialized dictionaries or glossaries were not used in this study, this issue remains unsolved here. Finally, "cohort" is found extensively all through the corpus in the sense described above, which shows evidence of conventional status in the discourse community, even though the frame is not defined in either CEDO or MWDTO.

6. Discussion

The CMT hypothesis that metaphor is present in any kind of discourse is corroborated by our results. However, no claims on metaphorical density can be adduced, since our procedure excludes the analysis of certain lexical types like prepositions and the general lexicon. Attention was focused on the lexicon referring only to the target domain, that is, the field of oncology and related clinical procedures.

Firstly, image metaphors offer the possibility of visualizing abstract phenomena such as different lymphoma configurations. Our results confirm that image metaphors are used to characterize specific categories by means of visual features. Secondly, according to our data, ontological metaphors predominate over imagistic, orientational and structural metaphors. That is an expectable outcome, given that ontological mappings project single entities, processes or events from source domains so that new concepts can be brought about in order to fill gaps in the vocabulary. The results also suggest that the use of expressions pertaining to structural metaphors like DISEASE IS AN ENEMY and TUMOURS ARE PEOPLES seem to be ingrained in oncological discourse.

As for cognitive functions of metaphor, the categorization function is used to create categories in the target domain given that no specific vocabulary exists for newly identified phenomena, thereby producing specific field terminology. Those expressions whose metaphorical specific meaning in oncology is not found in CEDO nor MWDTO correspond to technical terms. The metaphorical terms found in our survey corroborate this claim – "niche", "crosstalk", "homing", "cohort" and "bulky disease". As such, terms based on ontological metaphors "progressively acquire specialized meanings that are specific to the target domain" (Semino, 2011: 131). This study shows how ontological metaphors fulfil categorization purposes in the specialized field.

The conceptualization of the target domain as a complex set of conceptual relationships is led by two structural metaphors where the source domains supply conceptual material for the understanding of processes, events and participants configuring complex domains or scenarios. Thus, connecting the concepts of "attack", "aggressiveness", "defence", "resistance", "fight", "victory", "defeat", etc. offers a model to reason about disease treatment.

As for communicative aspects of metaphor, there is complete absence of any formal marks for intentional use of metaphorical language. Thus, our data clearly show that the oncology research register does not allow for deliberate uses of metaphor. The authors of this type of discourse seem to be unaware that the language they use is metaphorical. The source domain is not present in the mind of the writer, and there is no intention at all to call for it in the mind of the reader. This fact raises the question whether we deal here with dead metaphors. In our view, in spite of unconscious usage, metaphorical language is still a reality since the lexicographic evidence shows that both the literal primary sense and the metaphorical sense are conventional in the community, i.e. both senses are contemporary. This observation corroborates the thesis that

> [t]he analogical mapping is not only alive, it is now entrenched in the conceptual and grammatical system. What the entrenchment does is make the mapping less noticeable at a conscious level; but at another level, it is more available than ever for reasoning, inference transfers, and conceptual elaborations (Fauconnier, 1997: 22).

The results, therefore, show that there is no room for creativity in research papers in oncological discourse, but rather well established conventional language is used. Furthermore, even though some concepts have emerged via metaphor, no consciousness about mappings is actualized in the discursive activity.

7. Conclusions

Several limitations have constrained the validity of the findings in this work. Though the results may certainly represent a first approach to metaphor in this particular type of text (oncology research) the size of our sample does not allow for conclusive generalizations. Further study is needed in this particular context in order to unravel communicative aspects of metaphor usage, such as deliberate usage, conventionality and creativity, and their correlation with conceptual types and cognitive functions.

Nevertheless, the data analysed in this survey suggest that at least some technical terms and conceptualizations come about in medical science through metaphorical operations. Regarding conceptual metaphor types – imagistic, orientational, ontological and structural – all are active in the

specialized discursive community for the purpose of describing abstract frames and domains. Particularly, specialized research articles incorporate terminology grounded mainly on ontological metaphors, leaving image metaphors for the creation of very specific categories. On the other hand, orientational metaphor mappings, as they instantiate well entrenched conventional cognitive models, are present to a very much reduced extent. This fact points at an explanation for the descriptive character of medical research articles in contrast with other more argumentative kinds of discourse, like the press, where the pervasiveness of orientational and structural metaphors is highly apparent.

Regarding cognitive and discursive functions of metaphor we may conclude that cognitive functions are crucial for the descriptive nature of scientific discourse, whereas communicative functions are diminished. In addition, being both cognitive functions fundamental for the understanding of the field, categorization plays a special role in the generation of specialized terminology in order to refer to particular entities and processes. Regarding communicative functions, only conventional metaphors are used, being that usage utterly unconscious.

Finally, metaphors with categorization function are used non-deliberately and conventionally, as expected. On the other hand, metaphors with conceptualization function, whose use was expected to be, at least partially, deliberate and novel, also present a completely non-deliberate and conventional usage in oncological research texts.

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