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METAPHORICAL CONCEPTS AND THEIR COGNITIVE FUNCTIONS IN MEDICAL DISCOURSE: RESEARCH PAPERS VS. PRESS ARTICLES

Abstract

The aim of this paper is to disclose linguistic evidence of the use and function of metaphors in medical discourse, by comparing their incidence in two genres, namely research papers and press articles. For that purpose, a sample of texts in both genres is analysed. Four types of conceptual metaphorical projections are identified according to Conceptual Metaphor Theory (i.e. structural, image, ontological, and orientational). Subsequently, the relation of these mappings with cognitive functions – categorization and conceptualization – is described. The purpose is to explore the role these functions play in knowledge construction and their implications for communicative aspects of metaphor usage. The results suggest a characterization of metaphorical concepts in the two medical genres. The conclusions show divergent tendencies in the use of metaphor and its cognitive and communicative functions in the genres analysed.

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Key words

metaphor, conceptual mapping, cognitive function, genre, press article, research article, oncology.

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1. INTRODUCTION

A general assumption in cognitive linguistics states that the use of metaphors characterizes everyday thinking and pervades language, not only in certain communicative practices aiming at artistic or rhetoric effects but also in any kind of language from the most neutral to the most specialized (see Barcelona, 2003; Dirven & Pörings, 2002; Gibbs, 2008; Hampe, 2017; Kövecses, 2015; Lakoff & Johnson 1980/2003; Ortony, 1993; Semino & Demjén, 2017). According to this postulation, scientific and academic language, and consequently medical discourse, is characterised by the extensive use of metaphor. Conceptual Metaphor Theory (henceforth CMT) explores diverse aspects of this phenomenon, ranging from the conceptual architecture of metaphors as a cognitive device to their pragmatic role in communication (Steen, 2011). This paper aims to show some connections between types of conceptual metaphorical projection – mappings – and their adaptation to communication in different genres of medical language. For that purpose, firstly the types of conceptual metaphorical projection occurring in two different genres are illustrated through qualitative analysis, in turn pointing out their cognitive functions. Subsequently, the pragmatic adaptation of these types of projection to diverse genres for communicative purposes is discussed. The goal is to suggest a characterization of tendencies in terms of metaphor usage and cognitive function, so as to provide evidence on the role metaphorical models play in medical language communication.

This paper suggests that metaphor usage may be more or less conscious depending on the cognitive functions fulfilled by the metaphors in each particular genre. Attention is paid to the topic of cancer, which has a high level of social significance. Navarro i Ferrando (2016) shows preliminary evidence that the discourse addressed to the general public, like press articles, incorporates cognitive models based on culture and everyday experience in order to reason about cancer. Conversely, specialized formal genres, as the research article, are expected to differ in both the cognitive and communicative functions of the metaphors employed (Navarro i Ferrando, 2017).

2. BACKGROUND

2.1. Metaphors in medical discourse

A metaphor is understood here as “a cross-domain mapping in the conceptual system” (Lakoff, 1993: 203), a set of ontological correspondences between two domains, where the implicational system of the Source Domain (henceforth SD) provides a model for the conceptual relationships in the Target Domain

(henceforth TD). Metaphorical expressions constitute the surface realization of mappings between conceptual domains. Black (1955) points out that, though normally the figurative word is understood as a substitute of the literal one, sometimes there is no literal form at all and a metaphor appears just as “the use of a word in some new sense in order to remedy a gap in the vocabulary” (Black, 1955: 280). A discourse community shares a culture researching a common range of phenomena and associating each individual term with a set of criteria sufficient to distinguish its referents from other sorts of phenomena (Kuhn, 1983). As far as metaphorical models can provide coherence to many science spheres exploring the domains of the extremely large or the extremely small for human bodily perception, metaphor establishes links between our understanding of the world and scientific language (Brown, 2003; Kuhn, 1993). Therefore, communication in specialized domains may include certain unconsciously used metaphorical language, either in conventional ways or as novel usage (Zeidler, 2013). Once it becomes conventional, usage is generally undeliberate, contrary to the traditional claims of the rhetorical view of metaphor that describes metaphorical usage as deliberate and conscious.

Cimino, Clayton, Hripcsak, and Johnson (1994) point out several aspects that configure the effectiveness of medical terms, paying attention to two semantic criteria that determine the cognitive function of specialized concepts categorization, namely vagueness and ambiguity. Non-vagueness implies that terminological concepts must be complete in meaning. Thus, ‘ventricle’ is not usually considered a fully described concept, nor does it represent some generic class of anatomic terms, i.e. it means neither ‘heart ventricle’ nor ‘brain ventricle’ when taken out of context. Non-ambiguity, in turn, implies that concepts must have exactly one meaning and, where a term has two or more associated meanings they must be disambiguated into distinct concepts, e.g. ‘Paget disease’ must be split into ‘Paget disease of the bone’ and ‘Paget disease of the breast’ (Cimino et al., 1994: 37). Zhu, Fan, Baorto, Weng, and Cimino (2009) also examined quality factors in biomedical terminology including constraints such as concept orientation, consistency, non-redundancy, soundness and comprehensive coverage. Our study may shed some light on how a metaphor can help to meet these criteria. Scientific terms need to be precise and distinctive in order to make conceptual relationships explicit. This explicitness amounts to the straightforward evocation of further concepts associated with the term so that the cognitive domain, frame, or script where the term is conceptualized can be appropriately comprehended. Metaphor may be one conceptual tool for the achievement of this goal.

Yanoff (1988) illustrates genre diversity in medical discourse by analysing single, whole texts representing six major genres selected by physicians, context and purpose to be the key factors for her classification. As subtypes of referential discourse, texts with different purposes exhibit different logics, organizational patterns, and styles. Salager-Meyer (1994) shows hedging strategies in two written medical genres pointing out that choices depend mostly on communicative

purpose, i.e. degree of claiming and generalization. Gotti and Salager-Meyer (2006) present a collection of studies on oral and written medical genres covering a variety of themes, data, and research methods. Wilce (2009) describes cultural variation in medical discourse and variation across genres and registers, through conversation analysis and discourse studies, providing an overview on the rhetoric of medical discourse.

As for the incidence of metaphor in medical genres, Giannoni (2009) shows how frequency of metaphorical lexical items conveys the disciplinary values associated with academic medical discourse. In addition, conventional metaphor in medical scientific discourse reveals the relevance of metaphorical models like war, sport, the body-as-machine, personification, among others, in the conceptualization of medical processes and notions (Finatto, 2010; Huang, 2005; Masukume & Zumla, 2012; Mungra, 2007; Periyakoil, 2008).

Semino (2008, 2011) shows the variation of particular metaphors and their linguistic expression in different discourse genres for diverse purposes. Thus, educational texts show certain patterns of creativity absent in other genres (Semino, 2011). Through qualitative analyses of particular metaphors in medical discourse, she illustrates how metaphor adapts differently to genres of diverse social scope, mainly in terms of communicative and conceptual function (Semino, 2008; 2011; Semino, Heywood, & Short, 2004). Potts and Semino (2019) explore the use of cancer as a SD in metaphorical language in present day English. Their study reveals dominant views on those phenomena most often described as cancers, as well as how cancer is perceived and conceived of. Ho (2019) illustrates the incidence of cancer metaphor awareness in advertising, particularly focusing on the representation of patients as fighters.

Metaphor functions in medical discourse in popular media have been addressed by Camus (2009). In her view, no single metaphorical system suffices to represent the complexity of cancer-related knowledge. Metaphors used in combination perform persuasive, explicative and discursive functions, i.e. attracting the reader, structuring and explaining scientific concepts, and organizing the text into a narrative.

2.2. Metaphorical mappings and cognitive functions

Conceptual metaphorical mappings have received little attention in the analysis of medical discourse. Lakoff & Johnson (1980/2003) and Lakoff (1993) showed how the use of metaphor may favour a particular interpretation and how metaphorical models provide coherence to the conceptualization of abstract domains. Four types of mapping are distinguished:

1. Structural metaphorical mappings configure one complex domain in terms of another, typically developing a set of inference patterns and implications derived from the SD, which enables coherent understanding of the TD (e.g. LIFE IS A JOURNEY).
2. Image metaphorical mappings fulfil an iconic function (Lakoff, 1993: 229-231; Lakoff & Turner, 1989: 89-96) inasmuch as they map visual similarities, given that shape, colour, size and topology are attributes of basic categories in human conceptual systems. Image metaphorical mappings schematically profile very concrete aspects of experience, such as particular scenes or formal qualities of single entities.
3. Ontological metaphorical mappings depict abstractions such as activities, processes, events, attributes, relations, emotions or ideas, as something concrete, such as objects, substances, containers or persons (e.g. IDEAS ARE OBJECTS).
4. Orientational metaphorical mappings project spatial orientation onto abstract concepts (HAPPY IS UP, SAD IS DOWN), thus configuring a system of concepts on the grounds of spatial orientation (UP-DOWN, IN-OUT). Perception and motion provide grounding for the orientational configuration expressed by the metaphor.

Kövecses (2017, 2019) points out that the conceptual content of metaphorical mappings may be explained at diverse levels of abstraction (image-schemas, frames, domains, and mental spaces). Accordingly, both SD and TD in a metaphor are conceived of as knowledge configurations involving pre-conceptual patterns (image-schemas) together with a conceptual structure (concept, frame, domain). As a consequence, each metaphorical mapping type may bear particular correspondences with one or more levels of knowledge configuration.

Metaphor usually performs a task directly related to the contents of a theory or to the explanation of a phenomenon (Fauconnier, 1997: 165-168). When the observed reality escapes direct perception – e.g. microorganisms – scientists elaborate models to conceptualize the phenomena under investigation. Moreover, new facts demand new categories to designate such phenomena. Thus, science not only needs to name entities whose existence was previously unknown (categorization function), but also elaborate novel conceptualizations of new processes and complex configurations (conceptualization function). Categorization through metaphor 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). Categorization also produces a designation for the target concept and serves primarily to attribute specific properties to it (Glucksberg & Keysar, 1993). In contrast, conceptualization through metaphor leads to model elaboration to explain the relationships between the entities in the TD including frames, scenarios and scripts as knowledge configurations (Kövecses, 2015: 31-48). This

analogical process involves mapping and induced schemas from the SD and may cause extension and reanalysis of the TD (Fauconnier, 1997: 102-105).

In the conceptualization function, the speaker's intention is to lead the hearer through the configuration of concepts and relationships in the TD, either consciously or unconsciously. Steen (2011: 36) points out that a deliberate use of metaphor implies awareness of a cross-domain mapping and an intention to alert the addressee to that mapping, which indicates a specific rhetorical motivation. However, the categorization function, as Navarro i Ferrando (2017) suggests, usually responds to non-deliberate usage resulting from metaphors already conventionalized in the speech community; mappings are not processed online in the communicative act, so that the interlocutors categorize the concepts meaning directly as entities in the TD.

3. DATA AND METHOD

Manual qualitative analysis is conducted on a text sample on the specific topic HIV-related lymphoma, with the purpose of guaranteeing topic homogeneity in spite of genre variation. Genres show different degrees of formality and specialization depending on purpose and audience (Swales, 2004). As Biber and Conrad (2019) illustrate, genre comparison may reveal relevant factors for linguistic usage. Particularly, genre characteristics may serve as explanatory factors for divergences in metaphor usage between medical research papers and press articles (see Table 1). The participants in the communication event can determine not only the amount of metaphorical language, but also the kind of mappings employed and their cognitive functions. Thus, research papers dealing with a specific topic such as HIV-related lymphoma are written by teams of oncologists and addressed to professional colleagues, which can be considered a narrow audience scope, whereas press articles are written by single authors and addressed to a general cultivated audience, regarded as a wide scope. Additionally, oncologists maintain an interactive relationship with their colleagues, as far as mutual correspondence is expected or a research paper may be written in response to another. In contrast, the readership of press articles is not expected to respond on a regular basis. Especially relevant in metaphor analysis is the knowledge shared by the discourse community determining the use of specialized terminology in research papers. As far as the production of the two genres is concerned, press articles are written within short periods of time, activating everyday cognitive models in an accommodative use of vocabulary, opposite to the fixed conventionalized usage of research papers. In addition, communicative purposes play a role in style formality, since the expression of an epistemic stance and a strong commitment to factuality in research articles require highly precise vocabulary. Conversely, the attitudinal stance and an indulgence for opinion in press articles allows for certain

laxity in the use of vocabulary, fostering creativity. Table 1 shows a characterization of both genres according to their situational characteristics.

SITUATIONAL CHARACTERISTIC		MEDICAL RESEARCH PAPER	MEDICAL PRESS ARTICLE
I. PARTICIPANTS			
<i>A. ADDRESSOR</i>	<i>1. Single/plural</i>	team of researchers	single author
	<i>2. Social characteristics</i>	oncologists	journalists
<i>B. ADDRESSEE</i>	<i>1. Single/plural</i>	oncologists-narrow	public-wide
	<i>2. Self/other</i>	other	other
II. RELATIONS AMONG PARTICIPANTS	<i>A. interactiveness</i>	expected	not expected
	<i>B. social roles</i>	scientific knowledge	reporting social events
	<i>C. personal relationship</i>	peer, professional	no personal relationship
	<i>D. shared knowledge</i>	large	small
III. CHANNEL	<i>A. mode</i>	writing	writing
	<i>B. medium</i>	print/online	print/online
IV. PRODUCTION		revised and edited	revised and edited
	<i>period</i>	long term (months/years)	short term (day/week)
V. SETTING		scientific journal	newspaper
VI. COMMUNICATIVE PURPOSES	<i>A. general</i>	report, describe, explain	entertain, persuade
	<i>B. specific</i>	research findings	inform, narrate
	<i>C. factuality</i>	factuality	opinion
	<i>D. expression of stance</i>	epistemic	attitudinal
VII. TOPIC	<i>topical domain</i>	medical science	health
	<i>specific domain</i>	HIV-lymphoma	HIV-lymphoma

Table 1. Situational characteristics of research papers vs. press articles (adapted from Biber & Conrad, 2019: 109-110)

The data sets consist of 33 medical research papers on HIV-related lymphoma (84,431 words) and 32 press articles on the same topic (36,938 words). The medical research papers data include abstracts and text bodies, excluding titles, keyword lists, figures, tables, captions, footnotes, reference lists and authors' information. As for the press articles, title, author information, footnotes, captions,

or any additional linguistic information included in photographs or illustrations is also excluded from analysis. Regarding the data compilation, eight medical research papers, published between 2001 and 2015, were provided by oncologists¹ investigating HIV-related lymphomas in 2015, as part of a previous research sample where letters to the editor and editorials were analyzed in contrast to research papers (Navarro i Ferrando, 2017). The remaining 25 medical research papers in the present sample, published between 2015 and 2020, were compiled in January 2020 through a Boolean keyword search including the terms 'lymphoma' and 'HIV', mainly from <http://www.sciencedirect.com>, though some have been directly retrieved from open access journals (see Appendix 1).

Regarding the press articles data, ten articles published between 1991 and 2013 come from a sample compiled in 2015 from *The New York Times* online edition (Navarro i Ferrando, 2016). The remaining 22, published between 2015 and 2019, were compiled in December 2019 through a Boolean keyword Google search including the terms 'lymphoma' and 'HIV'. Source diversification serves the purpose of randomization to minimize the predominance of particular journalists' idiolects, recurrent in the health section of single newspapers (see Appendix 2).

The search for metaphorical expressions was guided by a selection of linguistic expressions that have meaning in cognitive domains different from HIV-related lymphoma. Metaphorical expressions were selected that activate concepts "which cannot be literally applied to the referents in the world evoked by the text" (Steen, 1999: 61 as cited in Semino et al., 2004: 1274). Thus, the expression 'crosstalk' has a primary meaning in the cognitive domain of communication but its meaning in context refers to HIV-related lymphoma. In order to corroborate this rather intuitive decision, a procedure for metaphor identification was applied on the selected items (see Pragglejazz Group, 2007; Steen et al. 2010).² A protocol was carried out for each linguistic expression under analysis so as to guarantee a reliable decision on its metaphorical use. The protocol determines the 'basic' literal meaning of the expression by checking this primary meaning in the Cambridge Dictionary Online (CDO) and Merriam Webster Dictionary Online (MWDO). In the second stage, the procedure for metaphor identification determined the contextual meaning by describing the concept, frame, script and/or complex cognitive domain evoked by the context. Sullivan (2013) offers an innovative approach to metaphor analysis emphasizing the relevance of frames (Fillmore, 1982) as semantic tools. Thus, for each metaphorical expression, a description of both the SD (literal, employing the information drawn from the dictionaries), and TD (contextual) as a frame, script and complex cognitive domain

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² Though MIP and MIPVU are procedural models suggesting a set of strategies adopted here, this research does not apply either of their protocols completely, since the British National Corpus or the Oxford English Dictionary are not used, and most importantly, metaphorical expressions are not searched for exhaustively, but rather a single TD topic is selected.

was carried out. If the compared SD and TD concepts result in diverse experiential configurations, then a decision is made on the metaphorical status of the linguistic expression. Finally, an account was provided of SD-TD, including cross-domain correspondences, implications and entailments (Lakoff, 1993; Lakoff & Johnson, 1980). In the process, attention was paid only to metaphorical language used to process information about the TD, i.e., phenomena associated with HIV-related lymphoma. This analysis provided a set of conceptual metaphorical mappings including structural, image, ontological, and orientational types. Each metaphor is understood as one or more conceptual mappings that may be expressed linguistically in diverse forms ('metaphorical expression'). In turn, each metaphorical concept is labelled following the convention (Lakoff & Johnson, 1980) in the form TD IS SD, e.g. TREATMENT IS WAR.

4. RESULTS

4.1. Types of conceptual metaphorical mapping

A total of thirty-six metaphorical expressions were found in both sets of data, amounting to 737 occurrences. Structural mapping types appear as multiple linguistic realizations expressing concepts in complex SDs. For the image, ontological and orientational types, each single metaphorical expression matches a metaphorical concept in a single frame. The metaphorical expression is used to designate the metaphorical concept if no additional or different term exists in the TD, i.e. when there is a gap in the vocabulary.

4.1.1. Structural metaphors

Structural metaphors manifest complex mappings from rich SDs onto enriched TDs. A set of linguistic manifestations show the implicational associations among diverse entities in the complex SD and provide coherence to the relationships among participants and processes in the TD. Accordingly, the denomination of a structural metaphor represents a complex configuration of multiple frames rather than a single entity or frame. Three structural metaphors occur in the data: TREATMENT IS WAR, HUMAN BODY IS A TERRITORY, and DISEASE IS A PREDATOR. Their frequencies are shown in Table 2; the figures in brackets show the total number of words per genre.

STRUCTURAL METAPHOR	METAPHORICAL EXPRESSION	RESEARCH PAPER ABSOLUTE FREQUENCY (84,431 words)	RESEARCH PAPER RELATIVE FREQUENCY PER 1,000 WORDS	PRESS ARTICLE (36,938 words)	PRESS ARTICLE RELATIVE FREQUENCY PER 1,000 WORDS
TREATMENT IS WAR	attack	0	0	25	0.676
	battle	0	0	7	0.189
	fight	1	0.011	18	0.487
	return	0	0	11	0.297
	weapon	0	0	1	0.027
	invade, invasive, invasion	8	0.094	4	0.108
	mobilize	4	0.047	2	0.054
	target	14	0.165	26	0.703
	equip, equipment	1	0.011	3	0.081
	combat	2	0.023	2	0.054
	hit	0	0	4	0.108
warhead	0	0	2	0.054	
arming	0	0	1	0.027	
subtotal 1		30	0.355	106	2.869
HUMAN BODY IS A TERRITORY	population	35	0.414	1	0.027
	colony	5	0.059	0	0
	migratory, migration	6	0.071	0	0
	site	43	0.509	0	0
	homing	26	0.307	2	0.054
subtotal 2		115	1.362	3	0.081
DISEASE IS A PREDATOR	dominant	4	0.047	0	0
	aggressive	65	0.769	9	0.243
	fight	0	0	5	0.135
	opportunistic	34	0.402	4	0.108
	gnaw	0	0	1	0.027
subtotal 3		103	1.219	19	0.514
	TOTAL	248	2.936 /1,000	128	3.464/1,000

Table 2. Metaphorical expressions of structural conceptual metaphors in research papers and press articles; absolute and relative frequencies per 1,000 words

The TREATMENT IS WAR metaphor manifests through expressions that depict medical care and treatment measures as war actions. The most relevant correspondence is probably the personification of tumour, or lymphoma. Literally, a lymphoma is not an entity but a biological process whereby cells produce the wrong substances due to diverse causes – viruses, chemicals or even radiation – and as a consequence, malfunction causes cells to die or mutate. The metaphor facilitates the understanding of both the actions to be carried out and the patients and doctors' attitudes. As something is conceived of as a person or an army, it is possible to reason about it in terms of a human action. Personification allows for the characterization of an unknown entity as possessing human attributes. As it is well-known in oncology today, lymphoma is a rather new concept in the history of language and is considered abstract as our human perceptual apparatus cannot

perceive it directly. Therefore, our conceptual system needs a structural metaphor for its understanding and a successful communication about it. The data reveal a set of collocations, semantic preferences and prosodies offering a picture of that *personified lymphoma*. Lymphomas are characterized linguistically as ‘malignant’, ‘aggressive’, ‘resistant’, ‘severe’, and consequently, as *an enemy* that both patients and doctors should ‘fight’ against. In the WAR metaphor, personification implies a collective conception of the enemy as an army, a huge group of individual soldiers (cells). Therefore, the personified lymphoma is understood as an army carrying out actions against the patient’s immune system. Lymphomas ‘attack’ (develop), ‘progress’ (extend), ‘invade’ (proliferate), ‘go away from’ (remission) and ‘return to’ (relapse) the ‘sites’ of ‘battle’. On the other hand, the immune system is conceived of as an army who courageously ‘resists’ and ‘counter-attacks’.

The data (see Table 2) reveal that this metaphor occurs more extensively in texts addressed to a wide audience than to an expert professional audience. Multiple facets of the mappings of body cells onto soldiers are exploited and expanded. T-cells activity is metaphorically described as the action of a military corps, as in (1):

(1) To make T-cells **search out** and destroy cancer, researchers must **equip** them to do several **tasks: recognize** the cancer, **attack** it, multiply, and live on inside the patient. (*The New York Times*, Sep 12, 2011)

SD concepts attributable to soldiers like ‘search out’, ‘equip’, ‘tasks’, ‘recognize the target’, and ‘attack’ contribute to the conceptualization of a cell manipulation process in its literal meaning. The SD provides a set of previously known conceptual frames making it possible for readers to conceptualize the complex domain of cell management.

Treatment is expressed in terms of a ‘furious battle’, strategies and diverse stages ending in victory or defeat. The data exhibit explicit expressions like ‘declare victory’ on the part of doctors, or ‘the war was on’, as reported by a patient. Table 3 shows an outline of the conceptual mappings across cognitive domains:

TREATMENT IS WAR	
disease (lymphoma)	enemy – army
disease (lymphoma)	target
infection	attack
worsening	enemy’s progress
getting better	enemy’s remission
relapse	enemy’s return

patient	fighter
immune system	army
immune function	defence
therapy	strategy
proliferation	invasion
reaction	response
cells' chemical reaction	fighting, battle
immunity	resistance
drugs	weapons
manipulating cells	to equip/arm

Table 3. The TREATMENT IS WAR cross-domain mappings

The mappings bring about a set of personification entailments like aggressiveness, severity, malignancy, thrusting, attack, response, going away, returning, etc.

HUMAN BODY IS A TERRITORY. Medical discourse represents the human body as a large territory where microorganisms are conceived of as large human groups, tribes, peoples or nations, who 'migrate' to different regions. Accordingly, oncological discourse shows a conceptualization of tumour cells as 'populations' 'invading' a region or zone in the body, 'homing in' on a 'site', forming 'colonies', as in (2) and (3).

(2) ... the chemokine receptor CCR7 regulates E-Myc lymphoma **homing** to lymph nodes and distinctive microanatomic **sites** of the spleen. (*Blood*, 2011)

(3) ... cells are partially **invading** germinal centers. (*Human Pathology: Case Reports*, 2019)

Relative frequencies in Table 2 show this metaphor is often used in research papers but occurs rarely in the press. This contrast suggests that the professional community uses the metaphor for the conceptualization of the HUMAN-BODY cognitive domain, but is not popular enough for reasoning about lymphomas in the discourse addressed to the general public.

DISEASE IS A PREDATOR. SD expressions evoking the frame of a predator hunting for a prey (victim) configure the patient-disease relationship metaphorically. Thus, the fact that a predator is conceived of as being 'aggressive' also entails patients' emotions like fear and a feeling of risk and danger. If the predator inflicts damage on its prey, it is 'severe'. A predator waits for the best moment to attack, looks for the weak spots showing an 'opportunistic' behaviour. The victim may react

producing a response to an attack. The predator becomes ‘dominant’ over the victim. Thus, the whole ‘story’ models the conceptualization of the disease-patient relation as a fight. In the data, tumours are described as having different kinds of dominant, responsive, opportunistic, or aggressive ‘behaviour’, as in (4):

(4) In patients with HIV, NHL often **behaves** more **aggressively** and presents at an advanced stage. (*British Journal of Haematology*, 2016)

Table 2 shows that the metaphor is used in the professional field in most conventional ways (dominant, aggressive, opportunistic), though it is also used for general audiences, where the genre allows for innovation with rhetorical effects, as in (5).

(5) ... she recounted a seven-year **battle** to slow down the tumor **gnawing** away her face. (*The New York Times*, Oct 7, 2017)

4.1.2. Image metaphors

Image metaphors establish a correspondence between SD and TD grounded in visual configuration similarities. The data (see Table 4) show four image metaphors based on visual effects serving to name kinds of tumour on the grounds of the display that the malignant cells present at the microscope. Firstly, the expression ‘diffuse’ implies a substance or light being “spread in many directions” (CDO) or “through or into a surrounding substance by mixing with it” (MWDO). Secondly, ‘effusion’ evokes an image of a fluid flowing out of a source “through a small hole” (CDO) “by rupture or exudation” (MWDO). The expressions ‘diffuse large B-cell lymphoma’ and ‘primary effusion lymphoma’ each specifically designates a tumour category. It is interesting that these metaphors are limited to these denominations. The verbs ‘diffuse’, ‘effuse’, and the nouns ‘diffusion’ and ‘effusion’ appear only in their literal sense since they describe processes that exactly match the dictionary definitions and do not constitute an expression of metaphor. The image metaphorical expression ‘bulky disease’ characterises diverse types of lymphoma or malignancy showing a larger size than expected, as in (6).

(6) Immunotherapy with stimulated autologous lymphocyte-activated **killer** cells in EBV-positive patients and radiotherapy for **bulky** and localised disease also have a role. (*Pathology*, 2019)

The metaphorical expression ‘starry sky pattern’ presents clearly a different kind of phenomenon, being used with a descriptive function. Whereas the three denominations are clearly established terminological conventions designating categories of lymphoma, ‘starry sky’ helps to conceptualize a phenomenon through a perceptually familiar model, a sky full of stars, as in (7).

(7) The lymphoma is characterised by a high mitotic rate, apoptotic cells, and multiple tingible body macrophages (**'starry sky'** pattern). (*Pathology*, 2019)

IMAGE METAPHOR	METAPHORICAL EXPRESSION	RESEARCH PAPER ABSOLUTE FREQUENCY (84,431 WORDS)	RESEARCH PAPER RELATIVE FREQUENCY PER 1,000 WORDS	PRESS ARTICLE ABSOLUTE FREQUENCY (36,938 WORDS)	PRESS ARTICLE RELATIVE FREQUENCY PER 1,000 WORDS
A LYMPHOMA IS A HEAVY OBJECT	bulky disease	7	0.082	0	0
A LYMPHOMA IS A FLUID	primary effusion lymphoma	12	0.142	2	0.054
A LYMPHOMA IS LIGHT	diffuse large B-cell lymphoma	36	0.426	0	0
CELL GROUPS ARE STARS	starry-sky pattern	5	0.059	0	0
TOTAL		60	0.709	2	0.054

Table 4. Metaphorical expressions of image conceptual metaphors in research papers and press articles; absolute and relative frequencies

Relative frequency shows that image metaphors are mainly used in research articles, but hardly appear in the press. In turn, the three lymphoma denominations, being technical medical terms, occur regularly in research papers and are practically absent from press articles.

4.1.3. Ontological metaphors

Ontological metaphors provide concepts for entities, events or processes in abstract or new domains on the grounds of semantic attributes taken from concepts already established in the language. Ontological metaphors map functional attributes from SDs onto TDs to create new categories in the abstract TD.

ONTOLOGICAL METAPHOR	METAPHORICAL EXPRESSION	RESEARCH PAPER ABSOLUTE FREQUENCY (84,431 WORDS)	RESEARCH PAPER RELATIVE FREQUENCY PER 1,000 WORDS	PRESS ARTICLE ABSOLUTE FREQUENCY (36,938 WORDS)	PRESS ARTICLE RELATIVE FREQUENCY PER 1,000 WORDS
AMOUNT OF VIRUS IS A LOAD	load	47	0.556	1	0.027
TUMOUR IS A BURDEN	burden	12	0.142	0	0
A BODILY HURT IS AN EVENT	event	64	0.758	0	0
A HOST CELL IS A NICHE	niche	8	0.094	0	0
MOLECULAR INTERFERENCE IS CROSS-TALK	cross-talk	11	0.130	0	0

UNEXPOSED TO PREVIOUS TREATMENT IS NAÏVE	naïve	5	0.059	0	0
A COMPLEX MOLECULE IS A CHAIN	chain	31	0.367	0	0
EARLY STAGE CELL IS STEM (CELL)	stem cell	24	0.284	26	0.703
TOTAL		202	2.392	27	0.730

Table 5. Metaphorical expressions of ontological conceptual metaphors in research papers and press articles; absolute and relative frequencies

Table 5 shows that specialized terms with categorizing function are very frequent in research discourse but rather absent from the press. Only one metaphor ('stem cell') has been transferred to general language, as the data suggest.

TUMOUR IS A BURDEN/AMOUNT OF VIRUS IS A LOAD. A tumour is conceived of as a 'burden' whereas a quantity of virus as a 'load' since they consist of a quantity of tumoral or viral material. Thus, these lexical units provide the attribute 'quantity of material as cause of an extra need of energy'. Consequently, the presence of virus is depicted as causing an additional effort to the infected cells in performing their normal biological functions, with the subsequent negative consequences. The metaphorical entailments prompt the use of contextual expressions in collocation with 'loads' and 'burdens' such as 'reduced', 'measured', 'carried', 'shed', considered 'heavy' or 'detectable', as in (8) and (9).

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(8) HIV-positive patients with lymphomas had more frequently-detectable EBV **load** at lymphoma diagnosis. (*Clinical Infectious Diseases*, 2019)

(9) ... patients with HIV infection have an increased incidence of non-Hodgkin and Hodgkin lymphoma during the first 3 to 6 months of ART [...], the time-frame in which our patient presented with his **aggressive** lymphoma and high tumor **burden**. (*Bone Reports*, 2019)

A BODILY HURT IS AN EVENT. MWDO and CDO define 'events' as particularly relevant or unusual happenings. As for lymphoma treatment, 'event' designates any infection or malignancy appearing at any moment between diagnosis and cure or death. Consequently, the metaphor A BODILY HURT IS AN EVENT expresses malignant occurrences as 'events', i.e. those that bring about disease, illness, impairment or worsening, as in (10):

(10) Tracheobronchial involvement, either primary or secondary, remains a rare **event** among HIV-patients with NHL and two different clinical and bronchoscopic patterns can be observed. (*Respiratory Medicine Case Reports*, 2017)

A HOST CELL IS A NICHE. 'Niche' primarily means a hollow space in a wall. In biology, a conventional meaning extension refers to a location suited to a group of organisms belonging to the same type or species ('ecological niche'), where it has adapted and survived. In oncology, a virus finds a niche as it infects tissue or cells for protein consumption. The frame used in biology is mapped onto the oncology frame, as in (11).

(11) ...CCR7-dependent lymphoma cell **lodging**, a process that is intimately linked with lymphoma cell access to survival **niches** in the T-cell zone. (*Blood*, 2011)

MOLECULAR INTERFERENCE IS CROSS-TALK. In the domain of technologically mediated spoken communication, 'cross-talk' is almost synonymous with 'interference', e.i. when unwanted information intrudes into the communication channel. In oncology, 'cross-talk' means that an external biological agent comes into contact with a cell and modifies its molecular configuration through interference with the usual molecular processes. In addition, this interference is usually reciprocal, as seen in (12).

(12) Within the **niches**, the lymphoma cells interacted with fibroblastic reticular cells in a reciprocal fashion. This **cross-talk** involved stimulation of the lymphotoxin β receptor. (*Blood*, 2011)

UNEXPOSED TO PREVIOUS TREATMENT IS NAÏVE. The basic meaning of 'naïve' refers to a quality of human personality caused by lack of experience about world affairs. The semantic feature mapped onto the domain of medical treatment is the lack of treatment experience. Patients and parts of the body, organs and cells are characterized metaphorically as 'naïve' as they are submitted to treatment for the first time, as illustrated by (13) and (14).

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(13) ...depletion of gut-**homing** CD4+T cells was also observed in ART-**naïve** patients. (*Cellular & Molecular Immunology*, 2017)

(14) Vinblastine at standard dosing (6 mg/m²) results in a >75% response rate in treatment-**naïve** patients. (*Seminars in Hematology*, 2016)

A COMPLEX MOLECULE IS A CHAIN. In biochemistry, 'chain' is a conventional metaphor expressing the strong links among diverse components such as atoms, molecules or chemical groups. Chemical chains are metaphorically 'light' or 'heavy' depending on the link power and the quantity of their components, as illustrated in (15).

(15) The free light **chain** (FLC) assay measures the concentration in the serum of immunoglobulinkappa (κ) and lambda (λ) light **chains** that are not attached to a heavy **chain**. (*American Journal of Hematology*, 2012)

EARLY STAGE CELL IS A STEM CELL. The expression 'stem cell' refers to an "unspecialized cell" (MWDO), "especially one taken from a person or animal in a very early stage

of development” (CDO) that can develop into differentiated types of cells. In the SD ‘stem’ designates the main stick-like central part or trunk of a plant from which leaves and flowers grow. This is the only ontological metaphor that is extensively used in the press articles data, which suggests that the term has been transferred to general language. The mapped attribute is a functional one, as in (16) and (17):

(16) Hematopoietic **stem** cell transplantation (HSCT) from an allogeneic donor with an HIV-resistant genotype [...] resulted in apparent elimination of HIV in a leukemia-affected recipient. (*Molecular Therapy – Methods & Clinical Development*, 2019)

(17) Doctors in Berlin are reporting that they cured a man of AIDS by giving him transplanted blood **stem** cells from a person naturally resistant to the virus. (*The Guardian*, Mar 5, 2019)

Ontological metaphorical mappings in the data represent entities or processes in the domain of oncology. The emerging concepts designate single phenomena observed in the specialized field which may seem bizarre to the lay public. The attributes mapped from the source frame onto the emerging concepts do not bring about further domain entailments or implications beyond their single frames. This lack of domain implications makes them suitable for their consolidation as specialized terms in the scientific field.

4.1.4. *Oriental metaphors*

Oriental metaphors express the understanding of a process or event in terms of spatial configurations. Two orientational metaphorical mappings have been found in the data (see Table 6). The status of ‘arise’ as a metaphorically used word may be controversial. MWDO distinguishes a set of physical senses – implying moving upward, standing up or getting up – from a set of more abstract senses with the meaning of coming into existence, to attention or originating. The physical senses show a clear orientational character grounded on perception. The second set of senses are considered here as metaphorical on the assumption that the perception senses are primary, older and more basic. The occurrences in the data, as seen in (18), respond to the abstract interpretation, since no direct perception is possible.

(18) Lymphoma can **arise** in a wide variety of anatomical locations (*International Journal of Surgery Case Reports*, 2016)

Doctors maintain medical control over patients. This activity is understood metaphorically as a physical process whereby patients are very closely followed so that contact is preserved. The word ‘follow-up’ designating either every single meeting between doctor and patient, a series of meetings, or the whole period of time over which that activity takes place, is a compound formed by the verb

‘follow’ plus the spatial particle ‘up’ that contributes to the orientational pattern. The SD projects a motion meaning (the verb ‘follow’) plus a clue to proximity and completed contact (‘up’).

ORIENTATIONAL METAPHOR	METAPHORICAL EXPRESSION	RESEARCH PAPER ABSOLUTE FREQUENCY (84,431 WORDS)	RESEARCH PAPER RELATIVE FREQUENCY PER 1,000 WORDS	PRESS ARTICLE ABSOLUTE FREQUENCY (36,938 WORDS)	PRESS ARTICLE RELATIVE FREQUENCY PER 1,000 WORDS
COMING INTO EXISTENCE IS ARISING	arise	8	0.094	1	0.027
CONTROL IS FOLLOW-UP	follow-up	63	0.746	2	0.054
TOTAL		71	0.840	3	0.081

Table 6. Metaphorical expressions of orientational conceptual metaphors in research papers and press articles; absolute and relative frequencies

Altogether, the TD – doctors controlling treatment – is metaphorically expressed as doctors following the patient’s disease at a very short distance. ‘Follow-up’ implies closeness, so that patients are lost rather than followed, if doctors cannot reach them. In (19), the lexical unit ‘reachable’ reminds the reader of the SD.

(19) Patients were followed every 6 months and were considered lost to **follow-up** if no longer reachable (*British Journal of Haematology*, 2015)

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Relative frequencies show that these two metaphors are rarely used in press articles. Conversely, they are frequent in specialized texts where they fulfil cognitive functions in the description of particular phenomena and activities.

4.2. Cognitive functions of metaphor

The use of metaphor is aimed at successful communication and understanding. The conceptual mapping types described in subsection 4.1. carry out cognitive and communicative functions differently in the analyzed genres. Two cognitive functions are identified here, namely concept categorization and domain conceptualization.

Image and ontological mappings project single entities or frames, and therefore, result in the emergence of categories designating particular phenomena, single events or processes. They provide categories for concepts in the TD and end up producing new terminology through reiterative use. Conversely, structural metaphors map whole implicational configurations resulting in enriched TDs. In other words, they facilitate the conceptualization of complex networks of

relationships, which turns out to be useful for explanatory and educational purposes.

Nevertheless, a qualitative analysis reveals that a structural metaphor (HUMAN BODY IS A TERRITORY) fulfils both the categorizing and the conceptualizing functions in oncological discourse. The expressions 'migration', 'homing', 'colony' and 'population' both designate categories of groups of cells or viruses, and their actions. These expressions elaborate concepts as categories of single phenomena or entities – ontological mappings – and give rise to terminology through conventional reiterative use. In addition, they participate in the complex configuration of the structural metaphor HUMAN BODY IS A TERRITORY. Thus, these categories help in the conceptualization of the disease as the occupation of territory by groups of cells.

Finally, the orientational mapping CONTROL IS FOLLOW-UP fulfils a categorizing function. The term 'follow-up' designates a process, with no further implications in the conceptualization of the cognitive domain, since no other metaphorical expressions appear associated with that process.

5. DISCUSSION

The data suggest that image metaphors play a role in the research paper genre but have no significance in the press article genre (see Table 4). Their incidence in research papers shows the cognitive function of categorizing particular phenomena on the grounds of visual patterns ('bulky', 'effusion', 'diffuse'). Furthermore, iconic language may in turn fulfil a communicative descriptive function in specialized language, as the expression 'starry sky pattern' suggests.

Oriental metaphors are the less frequent type in the sample, and may fulfil interpretive functions and imaginative functions. They map semantic functional attributes from the domain of physical experience onto an abstract domain. Thus, 'arising' evokes emerging from the soil in order to mean 'coming into existence' ('lymphoma arises'), while 'follow-up' evokes motion and contact suggesting control maintenance of a changing process. The incidence of orientational mappings is ten times higher in specialized texts than in press texts (see Table 6), which suggests that these mappings play a substantial role in professional communication.

The data also suggest that those metaphorical expressions that fulfil the categorizing cognitive function of technical terms (image, orientational and ontological mappings) are rather rare in press articles. The categorization function of ontological, image and orientational metaphors helps scientists to refer to relevant and newly described phenomena for which no previous vocabulary exists in specialized discourse. Accordingly, the categorization cognitive function of metaphor in scientific genres attains a descriptive textual function.

Conversely, the conceptualization cognitive function carried out by structural metaphors is necessary in genres addressed to the general public in order to enable fluent communication and a clear and straightforward understanding of the TD. The conceptualization function is enhanced in press articles by means of metaphor extensions instantiated in structural mappings. These creative extensions emerge through linguistic expressions that add new correspondences between SD and TD. Consequently, we suggest that non-specialized genres use the conceptualization function of structural metaphors with the purpose of guiding comprehension of phenomena in a TD which is too abstract or unknown to the public. At the same time, creativity and innovation through structural extension may be an effective tool in argumentative genres. Table 2 shows that the incidence of the TREATMENT IS WAR metaphor is nine times higher in the press than in specialized texts.

On the contrary, those structural metaphors used in research papers (e.g. HUMAN BODY IS A TERRITORY, DISEASE IS A PREDATOR) mainly keep a conventional usage, no enhancement through extension being found. This contrast points at the rigidity and conventionalization of specialized language versus the higher degree of creativity and innovation in press genres.

Genres display differences not only in the degree of consciousness (deliberate versus non-deliberate metaphor) but also in the types and degrees of creativity (novel versus conventional language) (cf. Semino, 2011). Higher creativity in the use of metaphorical expressions points at a deliberate use of metaphor. 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 SD in the mapping. The interlocutors process the metaphorical meaning as a comparison between the domains, that comparison being conscious if the metaphor is deliberately used. The use of inverted commas in the analysed data shows deliberate use mainly in press articles, though it is not completely absent from the research genre ('starry sky'). Moreover, in press discourse, the author's intention leads the reader in the process of configuration of both concepts and relationships in the TD, which reveals a conceptualization function. On the other hand, conventional metaphors normally occur in non-deliberate use, as it is mostly the case in research genres. According to Steen (2011), in non-deliberate metaphor use, the meanings activated by metaphorical expressions are processed directly as meanings in the TD, with no active mappings in the communicative act. Metaphor use may be, then, unconscious and the metaphor usually fulfils a categorization function, since the interlocutors categorize the concepts directly in the TD without carrying out an analogical mental process, as it is the case of the image, orientational and ontological mappings analyzed in this paper.

Thus, structural mappings, whose objective is to elaborate models (via analogical processes), fulfil a conceptualization cognitive function, being prototypically the result of deliberate use. In contrast, the categorization function prototypically results in the use of terminology that, being already known among the scientific community, is conventional and used unconsciously. Interestingly, research papers show a fairly regular use of two structural metaphors (HUMAN BODY IS A TERRITORY and DISEASE IS A PREDATOR), which indicates that the conceptualization cognitive function is also relevant in specialized language. The difference between genres resides in the degree of creativity, i.e. whereas the TREATMENT IS WAR metaphor shows a high degree of creativity in the press reflected in novel mappings, the two metaphors used in research papers, HUMAN BODY IS A TERRITORY and DISEASE IS A PREDATOR, show a much more conventional usage. These findings point at the idea that the cognitive function (categorization versus conceptualization) is not as relevant as genre, as a factor determining deliberate metaphor use.

6. CONCLUSIONS

The aim of this paper was to shed some light on the patterns of metaphor use in two medical discourse genres. The results of a qualitative analysis performed on a collection of research papers and press articles suggest that different types of conceptual metaphorical mappings fulfil diverse cognitive and discursive functions in the two analysed genres. In turn, the two analysed genres exhibit differences both in the predominance of conceptual metaphorical mappings as well as in the cognitive and textual functions that metaphors realize. Research papers tend to use image, orientational and ontological mappings with a categorizing function that produces specialized terminology in a descriptive textual type, together with conventional structural mappings that help in the conceptualization of the TD. On the other hand, press articles tend to use mainly structural metaphors allowing for innovative and conscious metaphor use (online mapping awareness), which in turn produces rhetorical effects. This is achieved through the extension of metaphorical structural mappings and creativity (cf. Kövecses, 2012), which may lead to a richer conceptualization of the TD and a use in argumentative genres.

This study presents evident limitations due to the moderate size of the sample analyzed. Lack of space also reduces the scope of the analysis to particular issues like conceptual mapping types and their cognitive functions. Further research on medical discourse genres and the role of metaphor may enhance our perspective on metaphor extension patterns (in structural metaphors) as well as on the semantic factors that contribute to the creation of new terminology by means of of metaphorical mappings.

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Appendix 1 Sources for research papers

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|--|--|
| <i>Acta Histochemica</i> (2019) | <i>British Journal of Haematology</i> (2001) |
| <i>AIDS</i> (2015) | <i>Cancer</i> (2012) |
| <i>American Journal of Hematology</i> (2012, 2013, 2015, 2016) | <i>Cellular & Molecular Immunology</i> (2018) |
| <i>Annals of Oncology</i> (2015) | <i>Clinical Imaging</i> (2016) |
| <i>Antiviral Research</i> (2019) | <i>Clinical Infectious Diseases</i> (2014, 2018, 2019) |
| <i>Biology of Blood and Marrow Transplantation</i> (2018) | <i>EClinicalMedicine</i> (2019) |
| <i>BLOOD</i> (2011) | <i>Enfermedades infecciosas y microbiología clínica (English ed.)</i> (2019) |
| <i>Bone Reports</i> (2019) | <i>Haematologica</i> (2008) |
| <i>Brazilian Journal of Infectious Diseases, The</i> (2019) | |

Human Pathology: Case Reports (2015, 2016, 2019)
International Journal of Surgery Case Reports (2015)
Molecular Therapy – Methods & Clinical Development
(2019)
Oral and Maxillofacial Surgery Cases (2015)

Pathology (2020)
Radiology case reports (2019)
Respiratory Medicine Case Reports (2017)
Seminars in Hematology (2016)
Virus Research (2019)

Appendix 2

Sources for press articles

The Times, Mar 5, 2019; May 1, 2019.

The Independent, Mar 8, 2019.

The Edmonton Sun, Mar 6, 2019.

Chattanooga Times Free Press, Jun 29, 2018.

USC NEWS, Jul 9, 2015.

The New York Times, Jul 4, 1991; May 24, 1994; Oct 6, 1998; Nov 13, 2008; Oct 20, 2009; Sep 12, 2011; Dec 9, 2012; Jul 3, 2013; Dec 6, 2013; Dec 23, 2013; Mar 23, 2015; Mar 28, 2015; Jul 31, 2016; Oct 7, 2017; Nov 26, 2017; May 6, 2018; Mar 4, 2019; May 2, 2019; Jun 12, 2019; Jul 17, 2019; Nov 6, 2019.

The Guardian, Feb 15, 2016; Sep 20, 2017; Mar 5, 2019; Mar 5, 2019; Jul 2, 2019.