

Metaphors of Cancer in Scientific Popularisation Articles in the English and Spanish Press

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To Ian, Carmen and Mónica

Acknowledgements

During the years spent working on this project I have thought about this thesis in a number of metaphorical ways. Sometimes as a plant that needed constant care and attention, sometimes as a building that was slowly reaching completion. When I was stuck, I would show my fighting spirit and continue to work, even though no obvious enemy was within sight. Most often, however, I have thought about this undertaking as a journey. The journey frame may have been motivated by the amount of literal travelling involved in the period I have been working on this dissertation. Therefore, I would like to thank the metaphorical and literal travelling companions who have supported, encouraged and guided me on this voyage.

First and foremost, I would like to thank my advisors Teun A. van Dijk and Helena Calsamiglia Blancafort for accepting to supervise my work and for supporting my application for a competitive grant from the Spanish Ministry of Education which has financed the present thesis. Thank you for your excellent guidance, flexibility and continued encouragement.

I am also grateful to Elena Semino, who supervised my work during my six-month research stay at the University of Lancaster. Thank you for the warm welcome you gave me at cold Lancaster and for your invaluable advice and attention.

I would also like to thank the metaphor scholars I had the chance to meet at several RaAM conferences I attended and who gave me the opportunity to discuss my work with them. A special mention and thanks in this regard go to Fiona Macarthur, Rosario Caballero and Gerard Steen for their kind words and counsel.

I am also indebted to my colleagues at Pompeu Fabra University – Montserrat González and Montserrat Ribas – and at the University of Cantabria – Francisco Gallardo, Cristina Gómez, Paula Rodríguez, Jesús Ángel González and Sergio Lobejón – for their support at different stages of this investigation.

Although we have never been colleagues at the same university and most often we were living in different locations, I would like to thank my “PhD fellows” and friends Mario Serrano and Paula Pérez for their encouragement, for showing great interest in my project and for the many hours spent listening and advising me on the challenges I faced with this study.

I would like to extend my heartfelt gratitude to my friends from Santander, Barcelona, Lancaster, Nottingham and Salamanca. Now that this journey is coming to an end, I will have time to thank each one of you in person and to enjoy the numerous cups of coffee and dinners that I have been postponing for the sake of this thesis.

My gratitude to my parents and sister is beyond words. Thanks for always being there for me, for your generosity, for your wise advice at the personal and professional levels and for your endless love.

Abstract

This thesis provides an account of the metaphors of cancer in a comparable English and Spanish corpus of 300 press popularisation articles. The aim is to identify relevant source domains that are employed in these articles to conceptualise the disease. Although a number of studies have explored the use of WAR metaphors in the discourse on cancer, there is still little understanding of the actual way cancer is presented metaphorically to the lay public in the press or of the range of source domains that conceptualise the target domain. Thus, in addition to the WAR, VIOLENCE AND AGGRESSION source domain, this study focuses on other metaphorical systems exploited to elucidate such aspects as metastasis, apoptosis, cancer treatments and cancer research. A text analysis was carried out with the aid of a corpus software program. The metaphors in the two subcorpora were compared quantitatively and qualitatively for cross-cultural differences in terms of their functions and patterning. Although cancer knowledge is popularised through similar metaphorical expressions, subtle differences have been identified in terms of metaphor density, choice of metaphor and the functions performed by these expressions.

Resumen

Esta tesis describe las metáforas del cáncer en un corpus bilingüe inglés-español de 300 artículos de divulgación en la prensa. El objetivo ha sido identificar los distintos dominios fuente relevantes que se emplean en la conceptualización de la enfermedad. Aunque varios trabajos han estudiado las metáforas bélicas utilizadas en el discurso del cáncer, todavía se sabe poco de la forma en la que el cáncer se representa mediante metáforas al público lego y de la variedad de dominios fuente que conceptualizan el dominio meta. Así, además del dominio fuente de la GUERRA, VIOLENCIA Y AGRESIÓN, este estudio se centra en otros sistemas metafóricos empleados para clarificar diversos aspectos como la metástasis, la apoptosis, los tratamientos del cáncer y la investigación oncológica. El análisis textual se ha realizado con la ayuda de un programa informático de análisis de corpus textuales. Las metáforas de ambos subcorpus se han comparado cuantitativa y cualitativamente con el fin de identificar diferencias transculturales en relación a las funciones y a los patrones de las mismas. Aunque el conocimiento sobre el cáncer se divulga a través de expresiones metafóricas similares, se pueden apreciar pequeñas diferencias en relación a la densidad metafórica, la elección de las metáforas y las funciones que estas expresiones desempeñan.

Preface

Since Susan Sontag's essay *Illness as Metaphor* (1978), the use of bellicose language in the discourse on cancer has been under the spotlight. Sontag sought to strip cancer discourse of war metaphors since her experience had shown her that these images could be damaging for patients. Although Sontag's highly influential essay served to spark a debate around the use of militaristic metaphors in a number of diseases and medicine in general, the truth is that war metaphors are so well entrenched in medical discourse that some scholars talk about biomilitarism.

The present thesis seeks to move beyond the debate over the acceptability or not of war-related lexis and to explore metaphor in the context of press popularisation articles. Together with other rhetorical strategies, the use of metaphor is generally regarded as a highly useful tool in the recontextualisation of science. The aim of this study is to explore other relevant source domains, besides militaristic metaphors, that are exploited in the press to popularise key aspects of cancer knowledge such as metastasis and apoptosis. In addition, the investigation seeks to examine the functions performed and patterns exhibited by the metaphorical expressions.

This thesis contributes to discourse analytical approaches to metaphor, more specifically to the existing literature on the recontextualisation of metaphor across genres. The research methodology applied in this project may prove useful for the exploration of the metaphorical conceptualisations of other diseases. This thesis can also provide valuable information to translators who use the pair of languages studied. In addition to purely linguistic disciplines, the results presented here may prove of interest to other areas of knowledge, such as medical humanities, the sociology of health and illness and science journalism.

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Chapter 1

Introduction

1.1 Subject of this study

The aim of this study is to describe the use of metaphor in a corpus of scientific popularisation articles on cancer published in the English and Spanish press. To this end, I have compiled a corpus of 300 popularisation articles from four quality newspapers, namely *The Guardian* and *The Times* (England) and *El País* and *El Mundo* (Spain). In line with the increasing trend in the humanities and social sciences, the study will take into consideration contributions from studies pertaining to different disciplines. Thus, it adopts an interdisciplinary approach to the object under study.

More than any other disease, it is perhaps cancer that has been most often related to metaphor. This to a great extent is due to the American writer Susan Sontag, who in her essay *Illness as Metaphor* (1978) critically advocated a metaphor-free view of diseases. Her main thesis was that the metaphors used for cancer had a stigmatising and discriminatory effect upon the patients afflicted with the disease. She was in particular distressed by the framing of cancer as if it were a war.

Sontag's urge to strip the discourse on cancer of its metaphors came shortly before a major shift in the understanding of metaphor occurred with the publication in 1980 of Lakoff and Johnson's seminal work *Metaphors We Live By*. Metaphor, which had been 'theoretically' relegated to the domains of rhetoric and literature for many years, gained an unprecedented role, because of its ubiquity not only in language but also potentially in cognition and behaviour. Although the two above-mentioned works have been

subjected to criticism and some of their claims require revision, they are generally regarded as landmark studies and were a source of inspiration in the early stages of this investigation. Information drawn from these two works raises the following questions. If metaphor is integral to language and, hence, to the discourse on cancer,

1. how are metaphors of cancer used in the context of press popularisation articles?
2. what are their roles in this context?
3. do they have, as argued by Sontag, a punitive effect?

The genre chosen for this study – popular scientific writing in the press – provides a suitable arena to investigate cancer metaphors for two main reasons. The first is that in this genre metaphor, like a number of other rhetorical strategies, is pervasive but it is of especial interest because it allows writers to construct and structure abstract or complex phenomena in more familiar terms for a lay audience. Since we are dealing with a disease whose very nature is so complex that it continues to challenge the scientific community, the transmission of discoveries in the field of oncology is made more accessible through the exploitation of metaphor. Secondly, it has been argued that the meanings people ascribe to illness are influenced by the discourses coming from the media (Lupton 1994: 84), where metaphors play an important role. This view is shared by the psychologist Carla Willig (2011), who, from a Foucauldian perspective, argues that when diagnosed with cancer, patients find themselves with a number of available discourses from which they can choose to elaborate their own narrative of illness. Thus, it becomes relevant to provide an account of the images of cancer which emerge from newspaper popularisation articles.

Since much of the ground-breaking biomedical research – wherever it is produced – is published in the top-tier English language journals, the popularisation of science in the Spanish press almost inevitably passes through an English-Spanish filter. As noted by Charteris-Black and Ennis (2001), who examined the metaphors in Spanish and English financial reporting, there is a lack of contrastive studies for this language pair on the use of metaphor in the recontextualisation of knowledge in specific fields. It is, therefore, of interest to investigate whether, with reference to cancer, Spanish journalists use the same metaphors as their English counterparts or whether they draw on different images that may be culture-specific.

1.2 Why cancer metaphors in press popularisations?

Although Sontag's advocacy of a metaphor-free rendering of illness is, in the light of current metaphor studies, impossible, she should be given the credit for drawing attention to the fact that metaphor plays a key role in the verbalisation of disease, and that it can affect patients' experience of their illness. Although her essay was published more than 30 years ago, the issue remains controversial, since newspaper columns and internet blogs discuss the appropriateness of militaristic jargon in the discourses of cancer. For instance, the writer Mike Marqusee (2009), who had been diagnosed with multiple myeloma, wrote a column for *The Guardian* stating: "I don't need a war to fight my cancer, I need empowering as a patient". *The New York Times* journalist Dana Jennings (2010) entitled an entry in the *Well* blog he wrote for the newspaper: "With Cancer, Let's Face it: Words are Inadequate". Jennings, who had been diagnosed with, and treated for, prostate cancer, said that the words 'fight' and 'battle' made him 'cringe' and 'bristle' and acknowledged that he never thought of cancer as a battle, but rather as a "journey, a quest out of Tolkien, or a dark waltz". Both pieces motivated subsequent postings in the comment section of the webpages by readers with similar and opposing views on the issue. This disagreement is natural, since there is no absolutely right or wrong metaphorical framing for the disease. In making sense of cancer and constructing their personal narrative for the disease, patients must consider the available choices and select the conceptualisation which best serves their purposes (Willig 2011). In doctor-patient encounters, for instance, oncologists are recommended to listen to the metaphors used by the patients and to work along similar lines (Reisfield and Wilson 2004).

For the purpose of this thesis, it should be noted that the context of popular scientific writing in the press differs greatly from that of personal cancer narratives or medical consultations. A newspaper article addresses the public at large, and it is, therefore, difficult to cater for the preferences of each individual reader. Nonetheless, it may be possible to omit certain potentially damaging metaphors if the same message can be conveyed through non-metaphorical language or if alternative images could be found.

It should also be emphasised that the role played by metaphor in popularisations is pivotal for the adaptation of scientific – and for the purpose of this study – of cancer knowledge. Metaphors are also pervasive in scientific genres so that, in the recontextualisation process, the same technical metaphors may be used or adapted, or new *ad hoc* metaphorical expressions may be created. The role of metaphor in the recontextualisation of science is steadily receiving increasing attention from scholars (Knudsen 2003, Semino 2008; 2011). One of the goals of this thesis is to make a contribution to the growing body of literature in this area.

Within metaphor studies, scholars have emphasised the importance of studying metaphor in naturally occurring data (Deignan 2005) and from the viewpoint of genre (Caballero 2006, Semino 2008). For the purpose of this dissertation, I fully embrace this stance. In general, metaphors are a multifunctional phenomenon, and evidently this also applies when they are used in popular scientific writing in the press. In bringing science closer to the public, journalists may draw on metaphor to entertain, to capture the readers' attention, to explain, to organise the text into a coherent narrative or to persuade – among other possible functions. For these reasons, this study is based on a specially designed extensive corpus of 300 popularisation articles that was considered large enough not only to identify a broad array of cancer metaphors but also to cover the full range of their functions in this text type.

Against the background of the controversy around cancer metaphors and given their crucial role in the recontextualisation of cancer in the genre of newspaper popularisation articles, this thesis addresses the more specific aims described below.

1.3 Purpose of this study

The general aim of this thesis is to provide an account of – and to contribute to a better understanding of – the role of cancer metaphors in popular scientific writing in the press. With this end in mind, I have carried out a contrastive qualitative discourse-analytical study of English and Spanish cancer articles aimed at an educated lay audience in which the following specific objectives are addressed:

1. To carry out a detailed and exhaustive analysis of the most significant source domains employed to conceptualise cancer in the corpus;
2. To explore in depth the communicative functions performed by the metaphorical expressions in the texts;
3. To contribute to the existing literature of the recontextualisation of metaphor across genres;
4. To compare the different conceptual metaphors identified in two comparable subcorpora to determine to what extent metaphor is influenced by culture in this particular kind of discourse.

To achieve these goals, it has been necessary to break down the general and complex target domain of cancer into more accessible target domains such as cancer processes and cancer research. This approach is reflected in part in the structure of the thesis and chapter topics.

1.4 Overview of the thesis

Chapter 2 introduces the subject of this study, cancer metaphors. First, it provides some basic notions of cancer in order to facilitate the understanding of the subsequent chapters of the analysis. This is followed by an overview of the different studies which, under the influence of Sontag's account, have dealt with cancer metaphors from a variety of approaches.

Chapter 3 presents and defines the practice of popularisation. Popularisation discourse is a broad field of study that has recently gained interest in discourse studies and which encompasses a variety of genres. Thus, in this chapter I will further delineate the specific text type that comprises the study corpus, namely, popular scientific writing in the press, and I will reflect upon the analytical implications of this choice of genre.

Chapter 4 outlines the theoretical assumptions of the analytical category in this study. Metaphor should be studied as a multifunctional communicative phenomenon from the standpoint of genre. First, there is a brief discussion of the main shifts of paradigms that

have taken place in metaphor studies and that have influenced the way in which metaphor is understood today. This chapter also introduces and defines relevant notions concerning the patterning and functions of metaphor and which will be applied in the analysis of the texts.

Chapter 5 describes and characterises the corpus used in the study and sets out the methodology employed for metaphor identification and applied in the analyses in the empirical part of this thesis, which is divided into five chapters, each dealing with the metaphors related to a particular aspect of cancer.

Chapter 6 deals with the metaphorical expressions from the WAR VIOLENCE AND AGGRESSION source domain, since it is a rich domain that serves to account for different aspects of cancer. Chapters 7 and 8 are concerned with the recontextualisation of specialised cancer knowledge in the press, and present the metaphorical expressions used to elucidate two crucial biological processes in the development of cancer, metastasis and apoptosis. Chapter 9 presents the analysis of the metaphorical systems which are used to convey cancer therapies. A distinction is made in this chapter between the way metaphors are applied to conventional and novel therapies. Chapter 10 focuses on the metaphors from the MOVEMENT FORWARDS source domain and explores in particular the functions and roles of these expressions and how they are used by scientists and journalists to evaluate and promote scientific discoveries.

Chapter 11 brings the thesis to a close. It reintroduces the main aims and examines the main claims that have been made throughout the study. It also points to possible limitations and discusses directions that can be pursued in future research.

Chapter 2

Cancer and its metaphors

2.1 Introduction

The purpose of this chapter is to provide the background to the subject of this study. Section (2.2) is a brief introduction to cancer as a disease and puts forward some basic biological notions for a correct understanding of some of the technicalities that will be encountered in the ensuing chapters. Section (2.3) presents a review of the literature which has focused on the metaphors of cancer. Much of the work discussed here stems from Susan Sontag's views on the metaphors used to talk about a number of illnesses: tuberculosis, cancer and AIDS. Sontag wrote two influential essays, *Illness as Metaphor* (1978) and *AIDS and Its Metaphors* (1989), which were published jointly in 1991.¹ Her work led to the discussion of illness metaphors from a range of perspectives, including the sociology of health and illness, medical history, medical anthropology and linguistics. Illness metaphors have been analysed within different frameworks and using a variety of research methodologies. Although the studies presented here are of an eclectic nature, they serve to illustrate the ongoing debate concerning the ways in which illnesses are framed by metaphor in Western culture. After presenting Sontag's remarks on the use of war metaphors in the discourse of cancer (section 2.3.1), I move on to consider the work of authors who have responded to some of Sontag's claims on the metaphorical language associated with disease. Section (2.3.2) is devoted to the work of scholars, the vast majority experts in biomedical fields, who under the influence of Sontag's account, have looked at the advantages and limitations of a war framing for medicine in general and for cancer in particular. Alternative framings for medicine and

¹ In this study, all page references will be to the 1991 edition.

disease are also discussed here. Section (2.3.3) focuses on studies which have addressed the use of metaphors for cancer in the press. Most of these have been carried out by scholars working in the field of sociology and other related subdisciplines. The last section (2.4) offers a summary of the chapter and discusses the relation of the works reviewed here with the overall goals of this thesis.

2.2 What is cancer?

In the popular imagination, cancer tends to be thought of as a modern disease (Mukherjee 2011: 37), but recordings of tumours can be found as early as 1600 BC in ancient Egyptian papyri (Pelengaris and Khan 2006a: 30). The name cancer has also been in use since antiquity. We owe the word ‘cancer’ to Hippocrates, who coined the word around 400 BC to designate not only a number of visible tumours but other pathological conditions involving the swelling of tissue. Hippocrates chose the word *karkinos*, the Greek word for ‘crab’, because of the resemblance between the crustacean and the tumour and the swollen blood vessels nurturing it (Mukherjee 2011: 47). Hippocrates, who is said to be the father of Western medicine, also proposed the humoral theory to explain illness. It was another Greek, the physician Claudius Galen, however, who fully developed this theory around 160 AD and applied it to cancer. According to humoral theory, the human body was composed of four types of fluids: blood, phlegm, yellow bile and black bile. Illness was the result of an imbalance of bodily fluids. According to Galen, cancer was the result of an excess of black bile (Mukherjee 2011: 48-49). Although humoral theory slowly started to be rejected during the 17th and 18th centuries (Mukherjee 2011: 51-54), little advance was made in the field of oncology. In fact, in 1914 the American cancer researcher, Francis Carter Wood, pessimistically admitted that “we have learned nothing, therefore, about the real cause of cancer and its actual nature. We are where the Greeks were” (Mukherjee 2011: 47). However, in the last 50 years significant progress has been made in the biological understanding of this disease thanks to the advances in the field of genetics. Nevertheless, the progress in the description of cancer biology has not been fully transferred to the treatment of most malignancies (Pelengaris and Khan 2006a: 2).

Although in its singular form ‘cancer’ may be perceived as a single entity, it is in reality an umbrella term for a wide array of neoplasms. The specialised literature defines cancer as a genetic disease which arises from mutations taking place in the genes, and results from the uncontrolled proliferation of mutant cells. Two types of genes play an important role in cancer formation: *oncogenes*, which accelerate the rate of cell division and growth, gain in function; and *tumour suppressor genes*, which are in charge of correcting DNA damage, lose function (Hanahan and Weinberg 2000: 57).

In a landmark paper, Hanahan and Weinberg (2000) presented a systematic compilation of what they called ‘The Hallmarks of Cancer’. The authors pointed to six alterations in cell behaviour that lead to malignant growth:

1. Self-sufficiency in growth signals. Normal cells need the presence of specific growth signals to divide or undergo mitosis. Cancer cells, in contrast, are able to generate their own growth signals by a number of molecular strategies.
2. Insensitivity to growth-inhibitory (antigrowth) signals. To counterbalance cell division, there is another type of signal which inhibits cellular growth or proliferation. Whereas normal cells are ‘obedient’ to signals, cancer cells manage to evade them and hence carry on dividing.
3. Evasion of programmed cell death (apoptosis). Normal cells have a limited life span, die and are replaced. Cancer cells by contrast manage to avoid this process through a variety of molecular strategies.
4. Limitless replicative potential. Normal cells also have an intrinsic program limiting the number of times they can divide. This program is independent of the above-mentioned three characteristics.
5. Sustained angiogenesis. In order to live, cells require nutrients and oxygen, which are supplied by blood capillaries. The formation of this vasculature is called angiogenesis. Tumour cells survive because they develop the ability to promote blood-vessel growth.
6. Tissue invasion and metastasis. Cancer cells are able to spread to different organs giving rise to secondary tumours, or metastases.

Current cancer research is devoted to the understanding of these processes and to the development of drugs and other methods to treat the multiple variants of this disease.

Cancer treatment largely relies on three kinds of therapeutic options: surgery – the removal of the cancer and adjacent tissue; chemotherapy – the use of drugs to eliminate cancer cells; and radiotherapy – the use of radiation to destroy cancer cells and to reduce the size of the tumour. Both chemotherapy and radiotherapy act in a nonspecific way and harm both healthy and cancerous cells.

Recent advances have opened up hopes for the creation of novel cancer treatments that will spare patients from undesired side-effects. The treatments currently being developed are based on the growing knowledge gathered from the Human Genome Project and aim to treat the above-mentioned abnormalities but to avoid harming healthy cells.

Although cancer is an ancient disease, it is only in recent decades that the scientific community has been able to make significant progress in the understanding and treatment of certain types of cancer. Despite the remarkable advances made, experts agree that there is still a long way to go. Given the high incidence of cancer and society's interest in this disease, new contributions to cancer knowledge are frequently reported in the media. However, the ways in which the disease is discussed or explained, not only in more popular genres but also in the specialised literature, have been questioned, particularly as regards the metaphorical renderings of the disease. The next section offers a review of some of the works which have addressed this topic.

2.3 Why worry about cancer metaphors?

A popular nursery rhyme states that “sticks and stones may break my bones, but words will never hurt me”. In the case of cancer discourse, however, it appears that words do matter. In this section I examine some of the works which have dealt with the metaphors of cancer, particularly those that have focused on martial metaphors. I begin by commenting on Susan Sontag's influential essays *Illness as Metaphor* (1978) and *AIDS and Its Metaphors* (1989). I then go on to discuss other publications which under the influence of Sontag's account, have reviewed cancer metaphors from a variety of approaches and using different research methodologies.

2.3.1 Susan Sontag's *Illness as Metaphor* and *AIDS and its Metaphors*

When approaching the topic of the metaphors used to describe illness, it is almost compulsory to begin by giving due credit to the writings of the late Susan Sontag. The author eloquently argued that diseases are made meaningful by metaphor and she was one of the first critics to warn us about the negative implications that the metaphors ascribed to illness could have for the patient. In her first essay, *Illness as Metaphor* (1978), she compared the images associated with tuberculosis and cancer. In the second, *AIDS and its Metaphors* (1989), she developed some of the issues introduced in her first essay and provided an account of the metaphors used in the discourses around AIDS.

It was her personal experience as a cancer patient that urged her to write *Illness as Metaphor*. Sontag was concerned about the negative meanings that were ascribed to illnesses such as cancer and AIDS, which for her were of a stigmatising and discriminatory nature. Sontag argued that by rendering these diseases a source of shame, patients would be reluctant to seek medical assistance, thus causing a delay in the treatment they needed. She famously advocated a metaphor-free view of cancer, on the basis that metaphorical images had a negative effect upon the patients. She stated her case clearly at the beginning of her first essay:

My point is that illness is not a metaphor, and that the most truthful way of regarding illness – and the healthiest way of being ill – is the one most purified of, most resistant to, metaphoric thinking (Sontag 1991: 3).

As long as a particular disease is treated as an evil, invincible predator, not just as a disease, most people with cancer will indeed be demoralised by learning the disease they have (Sontag 1991: 7).

Sontag was particularly concerned about the bellicose terminology surrounding the discourses on cancer, which she wanted to see removed. She also hypothesised that, once the scientific community had arrived at an understanding of the disease and had found a cure, the metaphors and myths attached to cancer would disappear. This, however, seems highly unrealistic, at least in the light of current conceptual metaphor theories which argue that metaphors are a fundamental and a persistent device in language and essential for our cognition (Lakoff and Johnson 2003).² This is

² In this study, page references will be to the 2003 edition of *Metaphors We Live By*. This edition includes the original 1980 text, together with an afterword by the authors discussing adjustments and developments that had been made after the book first appeared.

particularly relevant in scientific contexts, where metaphors are used not only as a tool to communicate and explain theories, but also as heuristic devices.

In *AIDS and its Metaphors*, Sontag addressed those critics who had questioned her somewhat limited view of the trope in *Illness as Metaphor*, especially with regard to her lack of appreciation for the cognitive role of metaphor: “Of course, one cannot think without metaphors. But that does not mean there aren’t some metaphors we might well abstain from or try to retire” (Sontag 1991: 91). She also made clear that her definition of metaphor was taken from Aristotle: “giving the thing a name that belongs to something else” (Sontag 1991: 91). While acknowledging that not all metaphors should be banned and that there are alternatives that are less “unsavory and distorting” (Sontag 1991: 179), the author restated her case with regard to militaristic metaphors at the end of her essay:

the effect of the military imagery on thinking about sickness and health is far from inconsequential. It overmobilizes, it overdescribes, and it powerfully contributes to the excommunicating and stigmatizing of the ill.

No, it is not desirable for medicine, any more than for war, to be ‘total’. Neither is the crisis created by AIDS a ‘total’ anything. We are not being invaded. The body is not a battlefield. The ill are neither unavoidable casualties nor the enemy. We – medicine, society – are not authorised to fight back by any means whatever... About that metaphor, the military one, I would say, if I may paraphrase Lucretius: Give it back to the war-makers (Sontag 1991: 180).

Sontag’s work attracted the attention of scholars working in different disciplines and had a mixed reception, with both detractors and supporters. The former raised a number of objections, most of which related to the lack of empirical basis for some of her claims (see, for instance, Donoghue 1978, Clow 2001), but here I will only focus on those works which addressed her remarks on language and metaphor more directly. For instance, the sociologist Nicholas J. Fox (1993), criticised Sontag’s urge to strip illness of metaphorical associations by pointing out a fundamental truth concerning illness and language:

Illness cannot be just illness, for the simple reason that human culture is constituted in language, and that *there is nothing knowable outside language*, and that health and illness, being things which fundamentally concern humans, and hence need to be ‘explained’, enter into our language and are constituted in language, regardless of whether or not they have some independent reality in nature (Fox 1993: 6).

Martha Stoddard Holmes (2011) also considers Sontag's claim as unrealistic. In addition, she warns that her plea might in itself be dangerous and rightly acknowledges the fundamental role that metaphors play in a patient's own illness narrative:

Sontag's argument against metaphors is itself dangerous, however, as a stopping place. A desire to retire certain metaphors is all too easily translated into a "metaphors are bad" or "good metaphor/bad metaphor" policy, and once we start scrutinizing "negative images," it's all too easy to slip into a ban on all images, all representation, because of the inherent potential that our figures will do harm. And, of course, stopping metaphors is like ceasing to eat or to breathe (Holmes 2011: 265).

Scott L. Montgomery (1993) explains that militaristic language has a long history in biomedical discourse, its systematic incursion into scientific discourse beginning in the second half of the 19th century with the establishment of Pasteur's germ theory. He goes as far as to suggest that this kind of language, which he labels as biomilitarism, should no longer be seen as metaphorical because it is intrinsic to scientific knowledge: "biomilitarism, as the language of science, is not really a metaphorical system any longer – if by metaphor one means applying to one thing the name that belongs to something else" (Montgomery 1993: 68). Montgomery, like Sontag, views metaphor in Aristotelian terms. However, while Sontag wanted to *give* metaphor *back* to the war makers, Montgomery considers that militaristic terminology *belongs* to scientific truth and should therefore be seen as having a literal and not a metaphorical meaning. Richard Gwyn adheres to Montgomery's claims in his book *Communicating Health and Illness* (Gwyn 2002), where he argues that: "it is questionable whether the military metaphor should really be considered a metaphor at all, or whether [...] its metaphoric currency is now dead" (Gwyn 2002: 138).

Nonetheless, metaphor scholars stress that military metaphors are 'alive'. For instance, the linguist, Brigitte Nerlich, who has extensively examined the metaphorical framing of a variety of diseases in public discourse, found that militaristic language also pervaded the discourse of foot-and-mouth disease and claimed that war metaphors, far from being dead, powerfully structured the political and public descriptions of the disease (Nerlich *et al.* 2002: 93). Nerlich and her co-workers argue that the use of war metaphors in the discourse of foot-and-mouth disease in the press served to justify what many came to view as the needless killing of animals (Larson, Nerlich and Wallis 2005: 255). They also explain why it is indeed necessary to keep track of militaristic metaphors in science communication:

As a well-entrenched cultural resource, military metaphors continue to be a dominant framing device employed by governments, scientists, journalists, and the public. However, exactly because such metaphors are so compelling, ubiquitous, and seemingly natural, it is all the more important to scrutinize the role they play at the interfaces between science and society and nature and culture (Larson, Nerlich and Wallis 2005: 244–245).

Other critics have pointed out that Sontag's approach to the issue was based largely on an informal analysis of literary images of disease combined with her own perceptions of popular culture and of scientific language (Seale 2001: 308).

In spite of all this, it should be acknowledged that Sontag was one of the first modern critics to argue that illness and disease is rendered meaningful through the use of metaphor (Lupton 2003: 61) and started a debate which remains open at the present time.

2.3.2 Biomilitaristic metaphors in perspective

Although the previous section argued that discourse of illness cannot be stripped of its metaphors, Sontag's two essays have inspired a number of scholars and medical professionals to examine and discuss the implications of the war framing for a number of medically related domains (illness, medical establishment, doctor-patient relations, and health care reform in America). The medical humanist Deborah Kirklin (2001), for instance, has argued that the study of metaphors portraying doctors and the practice of medicine might shed light on "the culturally perceived strengths, weaknesses and flaws of medicine" (Kirklin 2001: 89).

Some researchers have addressed the question of why the militaristic framing is so persistent in medicine. Reisfield and Wilson (2004) provide a number of reasons to explain why it is so prevalent. The war framing is ubiquitous in various domains in Western societies (war against drugs, poverty, obesity) and implies a call for action on the part of the professionals involved. In addition, there seems to be a perfect metaphorical correspondence between the two domains: enemy (cancer), commander (physician), combatant (patient), allies (health care system) and weapons (treatment). Furthermore, conceptualising cancer in terms of war restores to sufferers the power and determination which serious illnesses take away from them. Childress (1995) sees a

strong correlation between medical organisation and military hierarchy. He also points out the similarities in terms of training because both military and medical instruction involve diligence, sleepless shifts and discipline (Childress 1995: 1835). A further justification for war rhetoric in cancer discourse is the number of victims the disease has claimed, which exceeds in many instances the casualty figures of actual wars (von Elm and Diener 2007: 274).

Healthcare professionals argue that war metaphors not only shape their language but also have a powerful effect on the practice of medicine, sometimes negatively influencing their attitudes, moral beliefs and actions (Warren 1991: 39, Childress 1995: 1835, Reisfield and Wilson 2004: 4024). Thus, the militaristic framing has been criticised for discriminating against women since war is primarily a masculine activity (Hodgkin 1985). It is also power-based; it could encourage doctors to adopt a paternalistic attitude towards their patients and it is an inherently violent conceptualisation (Reisfield and Wilson 2004, Mitchell *et al.* 2003).

Rees and co-workers (2007) described the metaphorical conceptualisations of student/doctor-patient relationships. Their analysis includes six over-arching metaphors: student/doctor-patient relationships as war, hierarchy, doctor-centredness, market, machine and theatre. In relation to the war metaphors, the authors argued that:

Although our findings emphasise various entailments associated with the war source domain (e.g. stakeholders being on different sides and those sides being characterised by conflict), other entailments commonly associated with war were not found in our data. For example, there was no discussion about one side *surrendering* and accepting the *victory* of the other and there was no talk of *truces* between the two sides (Rees *et al.* 2007: 733).

An interesting observation that emerged from their work is that doctors and patients were described as being on opposing sides, thus underlining the barrier between lay and medical groups. In contrast, students and patients were often said to be on the same side, which emphasises the view of students as proto-professionals (Rees *et al.* 2007: 733).

A militaristic framing also implies that winning the war is possible if one fights hard enough. In certain types of cancers, however, the limitations of the weaponry plus the scant understanding of the enemy results in a considerable number of failures and losers (Reisfield and Wilson 2004). Other authors have criticised the analogy because there is

no room for sick people in war. In addition, when the patient is at a terminal stage, war imagery can be extremely discouraging (Stibbe 1998: 190).

The war metaphor has also been criticised because it may promote overtreatment as it encourages the desire to carry on with the fight, leading physicians and patients to embark on salvage therapies³ which may have scant medical benefit. Thus, the pursuit of a hypothetical cure may, in fact, be worse than the disease itself (Warren 1991: 41, Childress 1995: 1836, Reisfield and Wilson 2004). Professor of Cancer Nursing, Jessica Corner, has explored the consequences of militaristic discourse in the cancer clinic and has argued that it may result in drastic measures for the treatment of cancer:

The consequences of a culture of war, in cancer treatment, go far beyond simply the impact on the way in which the disease is discussed with those who have it. They are part of the biomedical construction of cancer management. A battle mentality is one where all means are justified, where the 'rules of engagement' are able to be redefined beyond those acceptable in 'peacetime', because it is necessary to defeat a hostile aggressor (Corner 1997: 176).

She argues, for instance, that this view encouraged the procedure of radical mastectomy for breast cancer for more than 60 years.

Childress (1995: 1836) has argued that the metaphor is so powerful that physicians and families may find it hard to let patients and relatives die. As a result, terminal patients refusing treatment may experience feelings of guilt and inadequacy (Reisfield and Wilson 2004). In addition, doctors may end up perceiving the patients refusing treatment as traitors (Warren 1991: 41). In fact, the psychologist Ellen Ormond (2009) recently complained about the press framing cancer in terms of a war, arguing that if patients do not win the *battle*, the implication is that they are *losers*. She also mentioned a patient whose tumour was progressing despite having been treated aggressively. The woman felt pressured by her family to 'not give up' and to go on receiving more chemotherapy even though she felt it would be useless.

The framing encourages the expenditure of money in the pursuit of a cure because in the context of war, the more weapons one has at one's disposal, the better. This downplays other important actions which could be adopted such as preventive measures and chronic care (Childress 1995: 1834). In the clinic, the focus lies on the biomedical

³ A salvage therapy is a type of therapy given to patients who do not respond to conventional treatment.

parameters of the disease, such as the scans and counts, excluding other important aspects for the patient, such as the social, psychological and existential implications of the illness experience (Reisfield and Wilson 2004: 4025).

Others have criticised the use of particular war-related metaphorical expressions. Writing for *The Lancet*, Erik von Elm and Markus K. Diener (2007: 274) view the intrusion of military terminology as a ‘corruption’ of biomedical communication and argue that it is not appropriate to draw on belligerent language to spice up research papers. They report on the indiscriminate use of the expression ‘collateral damage’ to describe both the side-effects of novel cancer therapies and the consequences of apnoea on bed partners. Hellman (2005) argues that the concept of the ‘magic bullet’, which has influenced medical research since the discovery of antibiotics, can also be problematic. He says that in the quest for a universal and effective therapy, cancer research may lose sight of more modest goals, with support being aimed towards fundamental research at the expense of other more pragmatic investigations which could have a more immediate application (Hellman 2005: 621). Grobstein, a biologist, believes that it is not possible to direct military action against cancer, as the disease does not consist of a single entity but of “a wide array of different disruptions in the growth patterns of the body” (Grobstein 2003).

Like Sontag, some patients (see Marqusee 2009, Jennings 2010) may find the military analogy extremely discouraging. Oncologists Reisfield and Wilson (2004: 4025) mention the case of a patient with colon cancer who referred to the war analogy as ‘less than palatable’: the patient, a veteran of the Vietnam war, was not keen to repeat, albeit metaphorically, that harrowing experience.

However, it is all too easy to fall into the trap of overstating the critique of the imagery of war, as it can also be useful for other patients. Reisfield and Wilson also mention the case of Cornelius Ryan, World War II historian and author, for whom the war analogy was empowering and enabling even when his disease was at a terminal stage. In his pathography *A Private Battle*, Ryan included a letter he had sent to a friend at the time when he was being treated for his metastatic prostate cancer. In the letter, warfare metaphors abound and help him construct his own illness experience:

About the best I can say to you is that I feel as though a half-track has rolled back and forth across my stomach nonstop for several days. I have a neat tattoo of the entire beachhead right across my abdomen... The attack was successful, although I am expecting a counterattack any moment from all sides, if any more of those nodes are malignant. Notwithstanding, I have surrounded myself by barbed wire, land mines, and several squads of infantry, and we are ready to take on all comers (Ryan 1981; quoted in Reisfield and Wilson 2004: 4025).

Linguist Arran Stibbe (1997), who investigated fighting and warfare imagery in doctor-patient encounters, claims that the war metaphor need not always be counterproductive, since it can sometimes engage the patients actively in their own healing (Stibbe 1997: 69). He describes a hierarchy of fighting at different levels in which the battle against the disease can be carried on by the government, doctors, drugs and patients. While the first three categories render the sufferer inherently passive, the conception of the patient as a fighter provides them with motivation, optimism and camaraderie (Stibbe 1997: 65-66). Nevertheless, as mentioned before, when the cancer reaches the terminal stage, the analogy may lead to despondency in the patient (Stibbe 1997: 68).

Another positive implication which has been pointed out is that the war framing helps to mobilise public and private support. Petsko (2001) claims that one of the reasons for current advances in the treatment of cancer and towards potential cures should be traced back to the 1970s, when Nixon's administration declared war on cancer. Petsko believes that this metaphor was highly successful in obtaining the funding for the investigations which are now paying off. He adds that people do not connect today's advances with the battle that started more than 30 years ago.

Since, in general, the limitations associated with militaristic rhetoric appear to outweigh the benefits, researchers have moved on to explore and to propose alternative framings for a variety of settings. A recent article in the *British Medical Journal* called for the battle image to be replaced with new images (Wiggins 2012). Physician George J. Annas (1995) argued in the *New England Journal of Medicine* that the ecologic metaphor could be a good alternative to the military and market framings of the health care reform in America. From a nursing perspective, Mitchell and co-workers (2003) argue that language resides at the core of how nurses think about themselves. They also find that metaphors play a crucial role in forming their self-image and in shaping their purposes in nursing practice. They point to the military metaphor as the one which has

influenced their work more than any other image but they believe that it is no longer useful. In their own words:

We assert that the metaphor has outlived its usefulness, and we call on our colleagues to declare its demise. It is our belief that the military model is a barrier to modern nursing concepts of client-centred care, personhood, participation, freedom, innovation and potential (Mitchell *et al.* 2003: 55).

They put forward the metaphor of the frontier as a more appropriate image to capture the current needs of their profession.

The journey metaphor has also been proposed as an alternative to the militaristic framing of cancer. Reisfield and Wilson (2004) find it particularly suited to cancer in the 21st century because certain cancers are turning into chronic conditions and, therefore, do not present a win/lose dichotomy. The authors list a number of correlations that can be explored within the journey analogy:

The exigencies of serious illness can force them [patients] to exit the freeway of life in which they had been traveling, often on “cruise control”, often at high speed, often with little thought but arriving at the next destination [...]. Importantly, the journey continues throughout the cancer treatment and beyond. The roads may be bumpy and poorly illuminated at times, and one may encounter forks, crossroads, roadblocks, U-turns, and detours. The pace, route and destinations of the journey may change, sometimes repeatedly (Reisfield and Wilson 2004: 4026).

Hodgkin (1985), while acknowledging that it is a difficult task to replace conventional metaphors with new ones, propounds the metaphor ‘medicine is a collaborative exploration’ as an alternative to ‘medicine is war’. The former would help doctors realise that they are engaged in an explorative activity whose very nature is uncertain. In addition, it carries the implication that medicine is a cooperative enterprise with many participants involved (patients, their families, health workers, and researchers) and that a successful outcome depends on working together (Hodgkin 1985: 1821).

2.3.3 Cancer metaphors in the press

Sontag’s influence can also be traced in the proliferation of studies exploring media representations of various illnesses and conditions both in humans – such as AIDS (Gwyn 1999) and severe acute respiratory syndrome (Wallis and Nerlich 2005) – and in animals, e.g., foot-and-mouth disease (Nerlich *et al.* 2002). Although the theoretical

framework and methods of analysis vary, the studies are linked under the premise that media accounts might have an influence not only on the personal experience of sufferers, but also on the public perception of illness (Semino 2008: 176), and have called for a more responsible use of militaristic metaphors. In the following I will review the works that have focused on cancer metaphors in the media.

Cancer metaphors in the press have been approached primarily by scholars working in the field of sociology. Lupton (1994) and Clarke and co-workers (1992; 1999; 2006) have found evidence in their studies of what Seale (2002: 172) calls ‘the oppression argument’, that is, that cancer representations in the media are “oppressive towards ‘real’ experiences of cancer”. The predominance of militaristic metaphors found in these studies was interpreted as a reflection and support of a “macho medicalized rhetoric” (Lupton 1994: 81) and of conventional Western medicine.

In his 2001 paper, Seale questioned some of the claims presented in Lupton’s and Clarke’s studies. Using both content and discourse analysis techniques, Seale (2001) examined 358 press stories in English of people with cancer. He argues that much of the lexis which under Sontag’s influence is said to have militaristic connotations in previous studies (e.g. Clarke and Robinson 1999), might equally well be related to sporting contexts:

Under certain circumstances, then, sporting narratives are potentially supported by much of the ‘struggle’ language that, under the influence of Sontag, commentators often categorise – and condemn – as the language of war (Seale 2001: 310).

Stibbe (1995) makes a similar observation, that sports metaphors can interact with fighting metaphors “and patients who are fighting their illness and focusing on winning sometimes switch to thinking about winning a game rather than a war” (Stibbe 1995: 140). Grant and Hundley (2008) analysed the visual metaphors for cancer victims and survivors present in Associated Press photos. The two dominant images were the sports and war metaphors. The authors concluded that while the sports metaphor can have positive implications for those afflicted with cancer, the war metaphor could isolate them.

Seale (2001), therefore, proposes the more overarching label of ‘struggle’ language and hypothesises that metaphorical expressions with more clearly militaristic associations might be found in popularisation articles in the press:

It is probably the case that language with purely military associations is more prevalent in news reports of scientific efforts to find new cures and treatments for cancer than it is in the reports of PWCs [people with cancer]. The evidence reported in this paper, however, suggests that it is more appropriate to describe the language of cancer in PWC reports as ‘struggle’ language, in which sporting connotations are evoked through the use of military metaphors (Seale 2001: 325).

He also questions the frequently made contention that war metaphors and struggle language have a negative effect on those afflicted with the disease. He rightly points out that scholars who defend this (Sontag, Clarke and Lupton) have not actually performed – nor for that matter do they cite – audience studies to support such a claim.

Hanne and Hawken (2007) searched for the metaphors used in the *New York Times* for popularising five diseases including cancer. They concluded that although military terms were still present, journalists had toned down the emotive force of the metaphors in response to Sontag’s work.

2.4 Summary and discussion

This chapter has introduced the subject of this study by first providing some rudimentary knowledge of cancer and then examining the work of Susan Sontag, since she was one of the first to argue that diseases are made meaningful by metaphor and to finger militaristic metaphors as susceptible to causing psychological harm to those afflicted with the disease. Although her plea to free cancer discourse of militaristic terms has been rightly deemed as unrealistic, her views have had a great influence, and reference to her essays is often found not only in blogs (Jennings 2010) and in newspaper columns (Marqusee 2009), but also in biomedical journals (Annas 1995, Reisfield and Wilson 2004, Wiggins 2012).

It is now clear that war metaphors are ubiquitous in the discourse of cancer, but despite the plethora of studies that have looked into this issue, the representation of cancer

research and how it is popularised in the press has been somewhat ignored. Contrary to Montgomery's (1993) assumption that biomilitaristic metaphors are dead metaphors and should be interpreted literally, the underlying premises of this thesis are more in line with Nerlich and co-workers' arguments based on their analyses of disease metaphors in the popular press (Nerlich *et al.* 2002). That is, I hold the view that war metaphors and other metaphorical systems that appear in the popular scientific press remain discursively alive and should, therefore, be scrutinised in order to account for the various roles that they perform in cancer scientific popularisation articles.

The chapter has also examined the work carried out by a number of professionals, including oncologists, biologists, linguists, psychologists and nurses, who have reflected primarily on the drawbacks of war metaphors for medicine and cancer. However, in line with Reisfield and Wilson's (2004) proposal, I hold that the suitability of a given metaphorical framing for cancer, or any other disease, is highly idiosyncratic. Moreover, since audience reception does not lie within the scope of this thesis, it is impossible to ascertain in an objective and reliable way whether metaphorical expressions have a negative effect. For this reason, I will not make any categorical claims in this regard. Nevertheless, the ongoing discussion of suitability will be borne in mind because of the influence that metaphors in general discourse are alleged to have upon cancer patients (Willig 2011) and in view of the opposition shown by biomedical experts, scholars and patients in relation to the militaristic conceptualisation of cancer.

Also reviewed here is the work of scholars who have focused on the study of the metaphors of cancer in the press. Seale's (2001) work raises interesting questions about the categorisation of metaphor, which remains an open debate among metaphor scholars, and which will be taken into account in the classification of the metaphors in this thesis. Seale (2001) also hypothesised that metaphors appearing in news reports of cancer advances would be more likely to have militaristic connotations than the metaphors present in the news corpus of stories of people with cancer that he analysed in his study. In this regard, this thesis will provide an answer to this issue. In addition, another aim is to extend the focus of the existing literature on war metaphors and to move beyond to the description of other metaphorical systems that appear in the press in relation to cancer and to investigate the ways in which these systems make scientific knowledge comprehensible and attractive to a lay audience.

I do believe that an exhaustive description of cancer metaphors present in the media could prove useful for doctors, health communicators and journalists, insofar as they can become aware of what image system they are activating when they talk or write about cancer.

Chapter 3

Popularisation discourse

3.1 Introduction

The previous chapter reviewed various studies concerned with the use of war lexis in cancer discourse. Many of these studies discussed the issue in a broad way, with little reference to the actual text types where war metaphors appeared, thus providing a decontextualised account of the tropes, although there are notable exceptions (e.g. Stibbe 1995, Seale 2002, Nerlich *et al.* 2002). In line with recent works investigating metaphor in discourse (for instance Semino 2008), an underlying assumption in this thesis is that the study of metaphor from a genre perspective can prove advantageous not only because it helps to delimit one's findings to a specific text type, but also because it allows the patterns and functions to be explored in detail. Thus, the purpose of this chapter is to describe and delimit the genre under study, i.e. popular scientific writing in the press. Section (3.2) provides a broad definition of popularisation, which is initially described as the communication of science that addresses a non-expert audience, and is a process encompassing an array of different text types and genres. Section (3.3) introduces the different ways in which the process of popularisation has been understood, paying special attention to popularisation in the realm of the press. Section (3.4) delimits how popularisation is viewed in this study, which feeds on works that have studied popularisation from a discourse analytical perspective, and outlines some of the textual resources exploited by journalists in the recontextualisation of scientific discourse. Section (3.5) deals with the constraints imposed by the new context in which science is presented, i.e. the press.

3.2 Popularisation discourse

Popularisation discourse has established itself recently as a new field of inquiry in discourse studies. It can be very broadly defined as scientific writing for the general public. According to Myers:

Popularization discourse includes only texts about science that are not addressed to other specialist scientists, with the assumption that the texts that are addressed to other specialists are something else, something much better: scientific discourse. An article in *Cell* does not belong in this field, but when the same author writes it up in *Scientific American*, or a science journalist reports it in *The Times*, or when a television documentary shows the scientist walking across a leafy campus, the same material becomes popularization (Myers 2003: 265).

Although from the quotation above, the distinction between scientific and popularised discourse appears fairly straightforward, it should be noted that popularisation is a matter of degree, and that, depending on the criteria adopted on what constitutes ‘genuine’ science and ‘popularisation’ science, this distinction will vary (Hilgartner 1990). Very often genuine scientific knowledge is conceived as being contained in a research article and lay knowledge as epitomised by a news report, but it should be noted that scientific facts are presented in many contexts (Hilgartner 1990: 524) and the development of a scientific claim involves a range of genres (Myers 2003).

If one considers the various contexts in which scientific communication takes place, it is more difficult to locate the boundary separating expert and lay representations. Science-making is a social activity with actors involved in a number of communicative situations such as writing a paper, talking with colleagues, delivering a paper at a conference or applying for funding; that is, scientific knowledge is presented in various contexts, ultimately giving rise to different scientific genres (Myers 2003: 270). Using Hilgartner’s terminology, this constitutes the ‘upstream’ side of a journal publication (Hilgartner 1990: 528). But also important for the work and prestige of scientists is to be cited in various text types which can range from review articles, textbooks and also media accounts (Myers 2003: 270), which corresponds to the ‘downstream’ side of a journal publication (Hilgartner 1990: 528).

In spite of the complications of delimiting where the process of popularisation begins, popularisation discourse, broadly understood, can be distinguished because it is a varied

discursive practice addressed at a non-expert audience and including a wide array of different genres (Ciapuscio 2000: 41).

Calsamiglia (1996; 1997) distinguishes two main channels for the dissemination of scientific knowledge. The first is institutional through schools and universities in the form of regulated teaching, and the other is through the mass media (newspapers, magazines, books, television, radio and the Internet). It is the latter that constitute popularisations of scientific knowledge. With regard to the media and in particular the written press, Alcívar (2009) draws an interesting distinction on the basis of the author of the popularised text: thus, scientists write scientific popularisations whereas journalists are involved in scientific journalism. He argues that scientific journalism is aimed for the benefit of society, by informing about the latest advances in scientific discoveries and technological innovations. In contrast, scientific popularisation is not a mere altruistic act on the part of the scientist, who may have other objectives such as fund raising or self-promotion (Alcívar 2009: 168). In practice, however, journalists are influenced by a number of external sources in the production of scientific news such as press releases issued by scientific journals or the scientists themselves, who may be interviewed and quoted in the texts (De Semir 2000a). Thus, although journalists and news editors ultimately decide what information to include in the final popularised news item, Alcívar's demarcation is somewhat limited when taking into account the actual process of newsmaking.

It is often assumed that popularisations constitute simplifications or distortions of a higher and more accurate observation of phenomena, but this appears to be a naïve account of the scientific process and the mass media. Both construct their own reality but they do so by following different criteria. The representation of scientific facts in the media involves a different context with different communicative goals and a different target audience. This will naturally have an influence on the information transmitted. Myers (1990) suggested that there is a discursive shift which creates different conceptions of the scientific endeavour:

Professional articles create what I call a narrative of science; they follow the argument of the scientist, arrange time into a parallel series of simultaneous events all supporting their claim, and emphasize in their syntax and vocabulary the conceptual structure of the discipline. The popularizing articles, on the other hand, present a sequential narrative of nature in which the plant or animal, not the scientific activity, is the subject, the

narrative is chronological, and the syntax and vocabulary emphasize the externality of nature to science practices (Myers 1990: 142).

In addition, the purpose ascribed to popularisations is normally said to be that of disseminating conceptual knowledge to increase the public's understanding of science. However, Alcívar (2004: 45) argues that the fundamental aim is to make readers understand the meaning and the practical consequences that a given scientific discovery could potentially have for their lives. Calsamiglia and van Dijk (2004) analysed a corpus of Spanish popularisation articles on the nearly accomplished sequencing of the human genome and found that the news items did not focus so much on biological or chemical properties, but on aspects of the social context of the imminent breakthrough. The articles included information primarily about the application of genome research to health, food and human reproduction, but also about the researchers participating, the laboratories, a general historical background on genetics as well as the 'race' between the different teams involved in the sequencing. More generally, popularisations of scientific articles also serve to entertain the public. Since the mass media provide commercial products, news content aims to attract the public's attention so that they ultimately buy more newspapers (De Semir 2000a: 125).

3.3 Models of popularisation

Popularisation in the press emerges as a triangular communication space between scientists, journalists and the public (Berruecos 2000: 106). The relationship between the three groups is rather complex, as is establishing the dividing line between what is understood by scientific knowledge and what is meant by lay knowledge (Davó and Álvarez-Dardet 2003). This complexity has given rise to two distinct modes of popularisation that attempt to explain the interrelations between the three above-mentioned groups. The canonical view is generally the one promoted by scientific institutions, but recent studies from the fields sociology and journalism have questioned some of the general underpinnings of this approach.

The so called 'dominant' or 'canonical' view of popularisation assumes science communication to be unidirectional, and involves a hierarchical concept of forms of

knowledge (Weingart 1998). In this ‘science centred’ view (Väliverronen 1993: 25), true scientific knowledge emerges from the scientists. Journalists then act as ‘translators’ rendering the highly technical and specialised scientific language into a more common and comprehensible variety of this same language (Bonilla *et al.* 2000). Although the notion of translation would imply an equivalence between the source and target texts, the resulting piece of information is often regarded as a simplification of the scientific article in the best case scenario and as a distortion or corruption of the original manuscript in the worst (Hilgartner 1990). In addition, according to this view, the public are passive receivers of scientific facts, incapable of judging the information received because of their ‘illiteracy’ concerning what constitutes ‘real’ science. In turn, journalists are considered to be uncritical mediators that bridge the gap between scientists and the public.

In contrast, the ‘critical paradigm’ of popularisation regards science and journalism as two different cultures, each with its own “institutions, language, legitimation needs and social interests” (Väliverronen 1993: 26), which results in the construction of different ‘realities’ (De Semir 2000a: 125). Furthermore, this approach dismisses a clear cut distinction between scientific and lay knowledge and defines the roles of scientists, journalists and the public in terms somewhat different from those of the canonical view.

Closer examination of the relationship between scientists and the media shows that it is more complex than the unidirectional model proposed by the traditional view of popularisation. Research indicates that the nature of this relation is symbiotic. The mass media constitute a forum where science competes with other institutions to justify their activity and attract public funding (Väliverronen 1993). Indeed, many scientists send pre-published results to the media to attract public attention since this practice is a way to gain time with regard to the generally slow process of scientific publication in scholarly journals (Weingart 1998: 871-72). Thus, for some researchers “contact with the mass media is a routine and planned part of scientific work” (Hansen and Dickinson 1992: 371). The mass media, in turn, also need the presence and active participation of expert sources to legitimise their claims and raise their own prestige (Väliverronen 1993: 30).

The critical paradigm also views scientific communication as a cyclic rather than a linear process in which discourses on science interact dynamically. Thus, on the one hand, the scientific community provides knowledge to be disseminated among the general public and, on the other hand, popularisations critically influence the production of scientific knowledge (De Semir 2000b: 12, Ciapuscio 2000: 48). According to Hilgartner: “Popularised knowledge feeds back into the research process as scientists learn about fields outside their immediate research areas from popular accounts, and these shape their beliefs about both the content and the conduct of science” (Hilgartner 1990: 522). In fact, scientific articles that are the object of prepublication press conferences have been shown to receive more scientific citations than those not popularised in this way (Friedman 2004: 3).

The traditional approach to popularisation also presupposed that science was an incontestable body of knowledge that records in an unbiased way how the secrets of nature have been revealed by scientific endeavour. However, science making cannot be considered as a neutral and objective practice because it is associated with people and their particular interests. Such a view of science obscures the evaluative aspect of scientific discourse (Hunston 1994: 192-193) and its function as a means of persuading the academic community to accept new knowledge claims (Latour and Woolgar 1979). It has also been pointed out that for researchers, popularisations of their discoveries can also represent a display window to promote their research and a means to capture public and private funding (Corbett 2006).

3.4 Popularisation as recontextualisation

The general framework that will be used in this thesis draws from studies that have approached popularisation from a discursive and linguistic perspective (Calsamiglia 1997; 2003). The point of departure in this approach is that the process of popularisation involves a *recontextualisation* of knowledge, which has been previously constructed in specialised contexts, and is *recreated* in another communicative situation for the lay audience. Therefore, within this perspective it is the communicative context that determines the register in which scientific knowledge is discursively represented (Calsamiglia and van Dijk 2004).

The characteristics of the new communicative context imply that the role of the journalist goes beyond the overcoming of mere terminological problems, as suggested by the journalist-translator model in the canonical view, since s/he carries out “a creative re-elaboration, an arduous task of reformulating previous texts that [...] involves all linguistic levels” (Ciapuscio 2000: 47-48).⁴ The processes of reformulation and recontextualisation encompass a series of transformations at the conceptual and linguistic levels based on the assumptions that the journalist makes about the public, what s/he is willing to communicate, the change of register and its communicative norms, the superstructure of news articles, and the organisation of the news agency.

Calsamiglia and van Dijk (2004) and Cassany and co-workers (2000) have examined the transformations required at the conceptual and linguistic levels. Here I provide a summary of the cognitive and linguistic strategies that, according to the above mentioned studies, journalists have at their disposal for the recontextualisation of scientific knowledge.

Taking as their point of departure the scientific paper that forms the basis of the popularisation, Cassany *et al.* (2000) argue that important transformations take place at a conceptual level. For instance, journalists are required to carry out a reduction in content so that the article includes only the information that is deemed of interest to the public. For example, conceptually complex procedures that are described in detail in a scientific article can be reduced to no more than a few lines in a popularisation in which explicit linguistic features and relationships are transformed into vague and indefinite expressions or may even be left implicit (Cassany *et al.* 2000: 83-84). On the other hand, journalists need to add or expand other information relevant to the new communicative context that is either absent from, or hardly developed in, scientific articles. Thus, popularisations, rather than focusing on the technicalities of the science and its conceptual relationships, inform the public about the social and human aspects of the scientific activity, such as personal details on the participating scientists, their affiliations, and social standing, together with the conflicts and problems faced in their

⁴ The original text reads: “una reelaboración creativa, una tarea de ardua reformulación de textos previos, que [...] compromete todos los niveles lingüísticos”. The English translation is mine, as are all the translations from Spanish in this thesis.

research. Since this information is probably more relevant in the readers' everyday lives, it is also likely to be more attractive than the purely technical knowledge (Calsamiglia and van Dijk 2004: 370).

At the linguistic level, general semantic strategies, or explanatory structures (Calsamiglia and van Dijk 2004), have been described as characteristic of the genre. These include denomination, definition and description, reformulation and paraphrase, exemplification and metaphor. It should be noted that, although metaphor is treated as a separate category, it can participate in all the different structures mentioned. Thus, denomination can be carried out via metaphor, as in the terms 'black hole' in astrophysics or 'greenhouse effect' in environmental science. A scientific notion can also be defined by drawing on metaphorical language. Thus, a term like metastasis will often appear in a newspaper article together with the metaphorical 'dissemination' included in an apposition.

In addition to the textual structures mentioned above, popularisation discourse in the press is influenced by the properties of the communicative context (Calsamiglia and van Dijk 2004: 371). Thus the communication of science will abide by the demands of news production, such as those imposed by the organization of the news agency, its communicative norms and the superstructure of news articles.

The internal functioning of news production has an influence on the generation of news reports of scientific content, which partly explains the nature of popularisation articles in the press. Like other mass media, a newspaper is a highly hierarchical institution, with news reporters located at the base and news editors at the top. News making, therefore, involves a series of revisions of an article performed at different levels by different members of the hierarchy: editors, media managers, section editors and reporters. Thus, rather than the product of an individual, the article is better portrayed as the outcome of a negotiation between interlocutors and as flowing in a series of individual episodes that follow a typical sequence: scientific journal article → press-releases → news item in the daily press → news story in the weekly and monthly press (Cassany *et al.* 2000: 77). This sequence is a simplification for practical purposes, there are of course other discursive practices involved such as "reading the press, participating in news conferences, making phone calls, interviewing sources,

participating in editorial meetings at the newspaper, talking to colleagues and searching the internet among others” (van Dijk 2008a: 103).

Furthermore, news articles are in direct competition with other items; journalists must, therefore, make their piece of work as appealing as possible not only for the public but also for the rest of the staff working at the news agency (De Semir 2000b: 20; Radford 2009). This competition for a *locus* in the daily press explains some of the traits which have been attributed to scientific news reports. For instance, there is a tendency towards the publication of dramatic and sometimes sensational scientific stories that are likely to attract the readers’ attention (De Semir 2000a: 127). In addition, popularisation articles have been criticised for presenting scientific results in a highly categorical way, and thus misrepresenting and exaggerating research findings. However, it should be noted that the media and science have different understandings of the ‘truth’. Science deals with ‘truths’ that are of a relative nature, often associated with uncertainties and susceptible to change as research progresses (De Semir 2000a: 125). For this reason, claims are often presented in a cautious and tentative manner. But the press is not interested in partial results, since uncertainties are not good sellers (De Semir 2000a: 125). Nevertheless, it should be noted that the minimisation of scientific uncertainties is problematic, if not unethical, in stories dealing with medical news. For example, advances made in the field of oncology may raise the patients’ expectations for a treatment although the scientific community may still be a long way from producing a treatment readily available to society (Revuelta 1998).

Tim Radford, former science editor at *The Guardian*, wrote an interesting chapter in a recently edited volume *Communicating Biological Sciences. Ethical and Metaphorical Dimensions* (Nerlich *et al.* 2009) from a workbench perspective. He described a hypothetical, yet possible, conversation between a science correspondent and a news editor:

A science correspondent goes to his news editor and says, ‘I have this very interesting report about a significant advance in the understanding of the development of small cell cancer, at least in laboratory mice. It is not a breakthrough. It is to put it at its strongest, an incremental advance in a very useful line of research that may one day illuminate the understanding of a biochemical pathway that leads to tumour formation. It is unlikely to result in a cure for cancer of any kind in the immediate future, or perhaps even in the long run. It does however throw interesting and instructive light on the process of

science, in my humble opinion.’ Half a second later, a sports reporter stumbles breathlessly to the same spot and says ‘The captain of the England team has been found off his face on class-A substances, in a bed with two tarts and a junior minister’ (Radford 2009:145–146).

He then raised the following questions: “which story, as a news editor, would you want to know more about? And which, as a reader, would you turn to first?” (Radford 2009: 146). Radford went on to explain that although the second story may have been an overstatement, it would probably have made it to the front page of the newspaper. The moral of his story, which he drew from his years of experience working in journalism, was that “while overstatement is not necessarily a good tactic, understatement is synonymous with no statement at all; and that whereas pride may indeed goeth before a fall, humility never even gets up off the ground” (Radford 2009: 146).

This helps to explain why news reports on science may appear sensationalist and excessively categorical. The competition to get a story into the printed press makes science correspondents minimise the uncertainties that are often present in scientific research. It should be noted that the role of popularisation articles is not only pedagogical, i.e. to provide scientific knowledge to the public. More importantly perhaps, articles dealing with scientific topics serve to point out how a particular discovery will be relevant to society and, in a general way, to offer the reading public entertainment.

The way in which science is transmitted to the public in the press is also constrained by the superstructure of news articles. The internal organisation of news items has been described previously (van Dijk 1988, Bell 1991), as has the rhetorical structure of popularisation articles, which has been characterised in terms of Swales’ (1990) rhetorical moves (Nwogu 1991, Sinclair 1998, Mapelli 2006). In the following I provide a general summary of the different constituent parts which are found in a press popularisation article.

Newspaper popularisation articles, like other articles in the press, display a macrostructure in the form of an inverted pyramid, with all the essential information included in the first section of the article (van Dijk 1988: 43, Mapelli 2006: 173) and

less important or non-essential details described in a second part that often tails off so that editors may shorten the text to meet space requirements.

Headlines function as a summary for the news article according to what the journalist deems most relevant (van Dijk 1985: 77) and also tend to be persuasive in that they draw the readers' attention to the text (Bell 1991: 189). In some cases, headlines are followed by subheadlines that introduce other important issues covered in the article. Leads have a similar function to headlines: in one or two sentences, they summarise the relevant information and act as a hook to entice the reader to read the rest of the story (Nwogu 1991: 120). As in other journalistic reports, the lead often deals with the five W-questions – who? what? where? when? and why? Popularisation article leads may also broach the 'how?' question in view of its relevance in the presentation and explanation of scientific discoveries and developments (Mapelli 2006).

The body of the article consists of a variable number of relatively short paragraphs that explain the research in more detail and elaborate on the aspects presented in the headline and lead. The features covered can include an initial evaluation of the relevance or impact of the study findings, information on the purpose of the investigation, background on technical issues or on the research team, and some brief information about the methods employed. The final part of popularisation articles often indicates the next steps in the research, points to future applications or reinforces the contribution made by the researchers with quotations from experts within the scope of the study.

Owing to the inverted pyramid structure, the information can be presented in more than one cycle, with each successive cycle showing decreasing relevance to the main impact of the news item. In addition, the most important points in the presentation of the research will usually be supported with both indirect and direct quotes from the scientists themselves or experts within the same field of knowledge.

3.5 Summary and discussion

This chapter provides a broad overview of the different ways in which popularisation has been understood. The canonical view holds the view that popularisation is a unidirectional process whereby scientific knowledge, which is generally contained in a scientific paper, is ‘translated’ into a more comprehensible version for the lay audience. Nevertheless, although a translation implies that the popularised version is equivalent to the source, the canonical view often holds that it is a simplification and a degradation of the original version. Research carried out from a number of disciplines in the social sciences (sociology of science, journalism and linguistics) have questioned this representation of the process. In this thesis popularisation discourse is defined as the recontextualisation of scientific discourse and as a transformation of specialised knowledge into ‘everyday’ or ‘lay’ knowledge. The new context to which scientific knowledge travels will necessarily have an effect on the popularised version. In the context of the press, for instance, a number of factors will have some bearing on the way in which science is communicated including not only the specific textual structures characteristic of news reporting, but also the constraints presented by the internal organization of the media, its communicative norms and the superstructure of news articles.

Although popularisation involves a range of genres, the corpus built for this study contains texts appearing in the written print media reporting on advances in the field of oncology, which include articles dealing with new treatments or biological findings.

Chapter 4

Metaphor in discourse

4.1 Introduction

Metaphor scholars [often] assume that metaphors can be taken out of discourse, and examined as individual entities, much as dead butterflies are pinned down in glass cases, to understand something of how they work. Just as butterflies are best understood out in the wild, metaphors are best studied and analysed within their natural contexts, as speakers and writers and producers of non-linguistic forms of metaphors are engaged in real cognitive and social work (Gibbs and Lonergan 2009: 252).

The above quotation neatly summarises the approach adopted in this thesis, which aims to study the role of metaphor as manifested in the realm of actual discourse. Metaphors, like butterflies, can be elusive, presenting difficulties to catch and to study. Nonetheless, it is only by examining them in their natural contexts that one can grasp their real essence.

The understanding of metaphor has changed considerably throughout history, even more so in the last few decades. For a long time, perhaps from a narrow reading of Aristotle,⁵ metaphor was perceived as a merely ornamental device, characteristic of the language of literature and rhetoric. But as Ortony (1975: 45) puts it, metaphors are not just ‘nice’, they serve a number of important cognitive, communicative and discursive functions. Thus, in recent years the view of metaphor as mere decoration has changed and an emphasis has been placed on the pervasiveness of metaphor in language and on the many roles it can take on in communication.

⁵ See Mahon 1999, Cameron 2003, Koller 2003a for a review of Aristotle’s work and its reception.

As scholar Gerard Steen and his co-workers recently claimed, “metaphor is booming business” (Steen *et al.* 2010: 1). The study of metaphor has indeed attracted an unprecedented amount of attention from various disciplines and perspectives in the past 30 years. The task of reviewing the different ways in which metaphor has been understood over time is beyond the scope of this project. Yet, for the purpose of this chapter, I provide a broad overview to outline the general underpinnings of this study. Section (2.2) offers a brief overview of Conceptual Metaphor Theory, which was brought about by the so-called ‘cognitive turn’ with the publication of Ortony’s *Metaphor in Thought* (1979/1993)⁶ and Lakoff and Johnson’s revolutionary *Metaphors We Live By* (1980). Section (2.3) addresses discourse approaches to metaphor, paying special attention to corpus based studies which examine metaphor from the standpoint of genre.

4.2 Conceptual Metaphor Theory

The study of metaphor has attracted scholarly attention for many years and reviews of the historical conception of the trope often date back to Aristotle’s contribution in the *Poetics* and the *Rhetoric* (see Cameron 2003, chapter 1 for a review). For our purposes, suffice it to mention that for a long time metaphor was viewed as a trope characteristic of language but only relevant to the fields of literature and rhetoric (Cameron and Maslen 2010: vii). In literature, it was conceived as an ornament whereas in rhetoric the alleged ambiguity and obscurity of metaphor made it something to be looked upon with suspicion. It was also assumed that metaphors always had a literal equivalent and that the understanding of metaphor required greater effort than the understanding of literal language (Deignan 2005: 2). As argued below, in such realms as science, this view led to metaphors being frowned upon and regarded as ‘parasitic’ because the ethos governing scientific endeavour was to arrive at a trustworthy description of reality through unambiguous, direct and clear language.

This traditional view of metaphor began to change by end of the 1970s with what has been labelled the ‘cognitive turn’ (Steen 2011a: 26). In 1979, Andrew Ortony edited a

⁶ This volume was first published in 1979 with the second edition appearing in 1993. Page references are to the 1993 edition.

collective volume entitled *Metaphor and Thought* in which a number of long held assumptions on metaphor began to be challenged, the most important development being that metaphor was a matter not only of language but also of cognition.

Shortly afterwards, Lakoff and Johnson published their seminal work *Metaphors We Live By* (1980) laying the foundations for the cognitive-linguistic approach to metaphor. Contrary to previous accounts, which saw metaphor as decorative, the authors claimed that metaphor was intrinsically linked to thought and that it was essential in language:

We have found on the contrary that metaphor is pervasive in everyday life, not just in language but in thought and action. Our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature (Lakoff and Johnson 2003: 3).

The theory was further developed and elaborated by the authors and their colleagues in a number of subsequent works (Johnson 1987, Lakoff 1987; 1993, Lakoff and Turner 1989). In *Metaphors We Live By*, Lakoff and Johnson defined metaphor as “understanding and experiencing one thing in terms of another” (2003: 5) and claimed that the metaphorical expressions present in language evidenced an underlying metaphorical conceptual system. Thus, it is important to distinguish two levels: conceptual metaphors, which are related to thought (conventionally represented in small capitals), and linguistic metaphors or metaphorical expressions, which are the realisations in language of a given conceptual metaphor (conventionally written in italics). An often quoted example from the authors is the conceptual metaphor ARGUMENT IS WAR, which they illustrated with the following linguistic realisations:

Your claims are *indefensible*
He *attacked every weak point* in my argument
His criticisms were *right on target*
I *demolished* his argument
I've never *won* an argument with him
You disagree? Okay, *shoot!*
If you use that *strategy*, he'll *wipe you out*.
He *shot down* all of my arguments.

(Lakoff and Johnson 2003: 4, emphasis as in original)

Lakoff and Johnson held that the italicised expressions reflected the fact that in Western cultures not only do we talk about arguments in terms of war, but we also partially think

about them in militaristic terms. Within this theory, conceptual metaphors consist of a ‘cross domain mapping’ or a ‘systematic set of correspondences’ between two conceptual domains: a ‘source’ domain, in this case WAR, and a ‘target’ domain, ARGUMENT.

The *source* is the conceptual domain from which metaphorical expressions are drawn to talk about a target domain. Source domains tend to be concepts that are more concrete and clearly delineated (Kövecses 2010: 7). Common source domains include the human body, health and illness, animals, plants, buildings and construction, machines and tools, games and sport, money and economic transactions, cooking and food, heat and cold, light and darkness, forces, and movement and direction (Kövecses 2010: 18-23). In contrast, target domains are often conceptually abstract, complex and poorly delineated phenomena. As such, they are prone to metaphorisation in order to be understood. Common target domains include emotion, desire, morality, thought, society and nation, politics, economy, human relationships, communication, time, life and death, religion, and events and actions (Kövecses 2010: 23-27).

According to Conceptual Metaphor Theory, the source and target domains are related through a set of mappings that are established between them. Nevertheless, the nature of these mappings is only partial and, as a result, certain features of the target domain are hidden and out of focus whilst others become highlighted. For instance, Lakoff and Johnson (2003: 10) argue that within the conceptual metaphor ARGUMENT IS WAR the cooperative aspect of arguing is lost. It is because of this partial account of the target domain that metaphor has been said to potentially introduce an ideological bias.

Whereas metaphorical highlighting affects the target domain, metaphorical utilisation applies to the source domain (Kövecses 2010: 91). Metaphorical utilisation involves the use of only some aspects of the source domain to account for the target (Kövecses 2010: 93). Kövecses illustrates metaphorical utilisation through the LOVE IS A NUTRIENT metaphor. He considers the following examples: “I’m *starved for* affection, He *thrives* on love, I was *given new strength* by her love, She is *sustained* by love, She’s *love-starved*” (Kövecses 2010: 93). He notes that in general terms the nutrient metaphor makes use of the ‘hunger/thirst’ and ‘desire/effect’ concepts of the source domain of nutrients. Other aspects from the source domain are left out: “no reference is

conventionally made to the idea that nutrients come into the body from outside, that we digest nutrients in order to process them, that eventually some of the nutrients goes out of the body” (Kövecses 2010: 94).⁷

Since a target domain is only partially accounted for by a source domain and since only a limited number of the elements from a source domain are utilised to account for a target, we inevitably require a range of source domains for a single target domain (Kövecses 2010: 96). Thus, according to Kövecses, abstract targets may be conceptualised by multiple source domains.⁸ Consider the following alternative metaphors for LOVE as cited in Lakoff and Johnson (2003: 49):⁹

LOVE IS A PHYSICAL FORCE (electromagnetic, gravitational, etc.): I could feel the *electricity* between us. There were *sparks*. I was *magnetically drawn* to her. They are uncontrollably *attracted* to each other. They *gravitated* to each other immediately. His whole life *revolves* around her. The *atmosphere* around them is always *charged*. There is incredible *energy* in their relationship. They lost their *momentum*.

LOVE IS A PATIENT: This is a *sick* relationship. They have a strong *healthy* marriage. The marriage is *dead* – it can’t be *revived*. Their marriage is *on the mend*. We are getting *back on our feet*, Their relationship is *in really good shape*. They’ve got a *listless* marriage. Their marriage is *on its last legs*. It’s a *tired* affair.

LOVE IS MADNESS: I’m *crazy* about her. She *drives me out of my mind*. He constantly *raves* about her. He’s gone *mad* over her. I’m just *mad* about Harry. I’m *insane* about her.

LOVE IS MAGIC: She *cast a spell* over me. The *magic* is gone. I was *spellbound*. She had me *hypnotized*. He has me *in a trance*. I was *entranced* by him. I’m *charmed* by her. She is *bewitching*.

LOVE IS WAR: He is known for his many *conquests*. She *fought for* him, but his mistress *won out*. He *fled from* her *advances*. She *pursued* him *relentlessly*. He is slowly *gaining ground* with her. He *won* her hand in marriage. He *overpowered* her. She is *besieged* by suitors. He has to *fend* them *off*. He *enlisted the aid* of her friends. He *made an ally* of her mother. Theirs is a *misalliance* if I’ve ever seen one.

Each of these different source domains will shape the target domain of LOVE in different ways.

Conversely, a single source domain may be used to talk about a number of target domains. This is what Kövecses calls ‘metaphorical scope’.¹⁰ The WAR source domain, for instance, is said to have a wide metaphorical scope, since it is applied to various and

⁷ Note that Kövecses is only referring to ‘conventional’ uses. Other aspects of the source domain can also be exploited in more ‘unconventional metaphors’.

⁸ Goatly (2011) refers to this phenomenon as ‘diversification’ (2011: 276-279).

⁹ See Kövecses (2000: 26-29) for more examples.

¹⁰ Goatly (2011) refers to this phenomenon as ‘multivalency’ (2011: 274-276).

varied target domains such as politics, illness, sports, arguments among many others (Semino 2008: 100).

Conceptual Metaphor Theory has had a great impact on a number of disciplines in the humanities and social sciences. Under the influence of Lakoff and Johnson's thesis that metaphors are pervasive in language and that they shape the ways in which we perceive our world, studies have been carried out to account for the presence of metaphor in a variety of settings and genres. Lakoff and Johnson's Conceptual Metaphor Theory, though illuminating, required some adjustments for its application to the study of metaphor in language and communication, as argued in the next section.

4.3 Discourse approaches to metaphor

Whilst Conceptual Metaphor Theory has served the purpose of drawing attention to the systematic nature of metaphors from a variety of disciplines including philosophy, anthropology, history, poetics, linguistics (Steen 2011a), current approaches to metaphor have addressed the potential limitations of the theory. From the perspective of applied linguistics and discourse analysis, a major problem that has been pointed out is that the theory aims to account for cognitive processes using language as evidence but the theory has neglected actual manifestations of metaphorical expressions in real discourse (Steen 2011b: 586, Caballero 2006: 5). At least from a discourse analytic perspective as Gibbs and Lonergan (2009) argue, metaphors, like butterflies "are best understood in the wild", that is in natural discourse.

This section addresses work carried out by scholars concerned with the actual manifestations of metaphor in real discourse, an approach that has been highly productive in recent years (Krennmayr 2012: 118). Researchers have looked at metaphor in general language corpora (Deignan 1999; 2005; 2010), conversational discourse (Cameron 2003), political discourse (Charteris-Black 2004, Musolff 2004), popular economics discourse (Porto 2012), popular business discourse (Koller 2004), literature (Semino 2008, Semino and Steen 2008), architectural discourse (Caballero 2006; 2013) academic discourse (Low 1999), and second language learning (MacArthur

and Littlemore 2011) to name just a few. By working with real language data, scholars have been able to point out a number of problems and limitations of Conceptual Metaphor Theory.

Scholars have criticised Lakoff and Johnson for basing their arguments on a collection of isolated and invented examples. This raises obvious issues of reliability. In a recent study, Krennmayr (2012) tested whether the metaphorical expressions provided by Lakoff and Johnson to illustrate conceptual metaphors in their famous book were actually ubiquitous and pervasive in language. She carried out searches using the Internet search engine Bing and restricted the results to those not containing [Lakoff] or [Johnson]. She found that the results yielded by the search engine decreased considerably when the authors' names were removed. Although Krennmayr acknowledged that there were arguably methodological problems with her study, through this informal analysis she had clearly made her point:

To develop a deep understanding of metaphor, it is thus necessary to move beyond decontextualized materials and linguistic examples that are not pervasive and possibly not even representative. If we want to understand how and why people use metaphorical language, what functions it performs, in what kind of situations and in what ways it is used, then we need to look at real language as it is used and produced in everyday life (Krennmayr 2012: 118).

However, the identification of metaphor poses a considerable challenge for discourse analysts. Generally speaking, scholars rely on their own intuition and do not spell out the criteria used for metaphor identification in their studies. Recently, attempts have been made to develop reliable methods for metaphor identification such as the metaphor identification procedure (MIP) developed by the Pragglejaz Group (2007) and a more recent and elaborated version MIPVU, developed at the *Vrije Universiteit* in Amsterdam (Steen *et al.* 2010). Questions regarding metaphor identification will be dealt with more thoroughly in chapter 5.

Another issue that has been raised is the difficulty in associating a particular metaphorical expression with its source domain. For instance, Semino *et al.* (2004) carried out an analysis of the metaphorical expressions in a corpus of conversations about cancer. The authors mention a number of methodological issues which they confronted when analysing their corpus and show that, depending on how one looks at the data, the ways in which conceptual metaphors are extrapolated will vary. They

analysed three metaphorical expressions which appeared in doctor-patient consultations: *galloping away*, *erupts* and *goes dormant*. In the case of *galloping away*, in the context described by the authors this could either refer to CANCER or to FAST DEVELOPMENT OF CANCER.

Along the same lines, Ritchie (2003) suggested that many of the metaphorical expressions which are often subsumed under the WAR source domain in the conceptual metaphor ARGUMENT IS WAR could also be related to other source domains such as CHESS or BOXING. Semino (2006) arrived at a similar conclusion in her analysis of speech activity in English. She shows that:

Lakoff and Johnson's ARGUMENT IS WAR only accounts for some of the expressions which construct verbal conflict in terms of a physical conflict, and that it should therefore be replaced by a more general conceptual metaphor, which I refer to as ANTAGONISTIC COMMUNICATION IS PHYSICAL CONFLICT (Semino 2006: 36).

Research into metaphor in naturally occurring language has benefited greatly from developments in corpus linguistics. Deignan's work on general language corpora is illustrative of the insights into metaphor study provided by the use of large amounts of data. In her book, *Metaphor and Corpus Linguistics* (Deignan 2005) the author tested the validity of some of the basic assumptions of Conceptual Metaphor Theory using corpus analysis techniques on a cross-section of the Bank of English consisting of around 56 million words, with the aim of exploring whether "a theory of metaphor as thought can account for the patterns found in natural language" (Deignan 2005: 2). Her analyses revealed that metaphors are both more dynamic and more restricted than what is suggested in a narrow reading of Conceptual Metaphor Theory (Deignan 2005: 215).

For instance, Deignan's analysis of metaphorical and non-metaphorical uses of verbs of movement showed that whereas the literal uses of *rock*, *move* and *stir* can appear in active and passive constructions, their metaphorical uses tend to appear in passive constructions (Deignan 2005: 149). Her account of animal metaphors is also interesting. Although classical pragmatic approaches to metaphor have often centred their discussion on examples such as 'Richard is a gorilla' (Searle 1993), Deignan's study shows that this kind of nominal metaphorical equation is rare in the corpus. Indeed, when animal metaphors are used to describe human characteristics, there is a grammatical shift from noun to adjective or verb. In explaining this shift, the author

suggests that animal metaphors are used to explain human behaviour and attributes, which are typically expressed by verbs and adjectives respectively (Deignan 2005: 152-155).

Some researchers, however, have built their own corpus to study metaphor in a specific genre or register. The aim is generally to arrive at a clearer understanding of the different forms and functions of metaphors in a given text type. Charteris-Black (2005) carried out an analysis on a corpus containing speeches by Churchill, Martin Luther King, Margaret Thatcher, Clinton and Tony Blair and George W. Bush to explore the persuasive use of metaphor by these influential leaders. Cameron (2003) built a corpus of classroom discourse to examine the following issues: “how metaphor is used in educational discourse; how students understand the metaphors they encounter; how metaphor contributes to learning” (2003: 50). In her study of metaphors in architectural discourse, Caballero (2006) outlines the advantages of adopting a genre approach to the study of metaphor:

In the first place, a given genre within a range of discourse practices of a professional community constitutes a manageable research context, and one that helps researchers delimit the scope of their findings within a particular context or situation – therefore preventing them from making generalizations that might not be valid for other contexts. Furthermore, knowing how the chosen genre works would provide metaphor researchers with default assumptions on the topics, relationship between authors and audiences, rhetorical goals and prototypical textual organizations from which his/her research may operate (Caballero 2006: 6).

In addition, scholars have also addressed the study of metaphor variation across genres. Semino, Deignan and Littlemore (2013) have recently put forward an approach for the analysis of metaphors in different genres and registers which draws on the notion of recontextualisation as proposed by Linell (2009), who describes three types of recontextualization. One type involves the “use of the same or similar ideas or expressions several times within the same stretch of discourse” (Linell 2009: 248). Semino and co-workers illustrate this type by referencing Cameron’s (2011) study, where she shows how metaphor indeed evolves within the same conversation. Interlocutors may adopt and develop each other’s metaphors in the negotiation of topics and to achieve mutual understanding. Another type involves a more abstract kind of recontextualization in which “orders of discourse (Foucault), genres or activity types, may also borrow from other genres or activity types” (Linell 2009: 248). In terms of metaphor, this pattern could arguably be seen in the application of a source domain to a

target domain (Semino *et al.* 2013: 43). For the purpose of this study, I am particularly interested in the third type of recontextualisation, where “one text or piece of spoken discourse may re-use or allude to elements of other specific texts or discourses” (Linell 2009: 248). This type of recontextualisation is relevant in the popularisation of science. As seen in chapter 3, news popularisation articles can be defined as an instance of knowledge recontextualisation in which specialised scientific knowledge is adapted for the benefit of a lay audience (Calsamiglia and van Dijk 2004). Given the very nature of metaphor, in which an abstract, unknown or poorly delineated concept is understood through a more concrete and familiar domain, it comes as no surprise that metaphors play an important role in the adaptation of specialised scientific knowledge in popular genres. In recontextualisation, new *ad hoc* metaphors may be created, but metaphors from specialised genres may also ‘travel’ to more popular ones and these metaphors may be creatively elaborated to perform a number of roles in the new genre.

Semino’s study (2011) of the adaptation of scientific metaphors across genres is a good example of Linell’s third type of recontextualisation. The author investigated how a scientific metaphor developed by scientists to provide a theory of pain and designated the ‘Gate control Theory of Pain’ was adapted in three educational genres: a website aimed at children, a self-help guidebook, and a book that addressed medical professionals. The original theory draws on the source domain of GATES to account for the target domain of PAIN. The author noted the following changes in the educational genres studied:

The GATE scenario has been exploited as a source of further non-technical terminology that contributes to the writer’s explanatory goals [...]. Second, the original version of the metaphor has been developed by modifying and expanding the source scenario, and by changing, in part at least, the target domain it applies to (Semino 2011: 148).

Another approach to the study of metaphor is critical metaphor analysis. In his 2004 book, Charteris-Black brings together approaches from critical discourse analysis, corpus analysis, pragmatics and cognitive linguistics and applies them to the study of metaphor. The author provides evidence for the important role played by metaphor in the development of ideologies with examples drawn from political genres, press reports on sports and finance, and religious texts.

The recent focus on metaphor from a linguistic perspective has revealed that it is a phenomenon with varied textual manifestations, versatile in function and central to different kinds of communication (Semino 2008).

4.3.1 Metaphorical patterns in discourse

Discourse approaches to metaphor have increasingly paid attention to the varied ways in which metaphor presents itself in actual texts. Building on previous studies (Goatly 1997/2011, Darian 2000, Cameron and Stelma 2004), Semino (2008) provides a list of some of the textual manifestations of metaphors in discourse: *repetition*, *recurrence*, *extension*, *clustering*, *combination and mixing*, *literal-metaphorical oppositions*, *signalling*, *intertextual relations*. The author emphasises that in texts, these patterns do not present clear-cut boundaries, and that there is a degree of overlapping between some of them.

The different patterns metaphorical expressions exhibit in a text may also be related to some more general textual or rhetorical goal. Textual patterns such as *repetition* – the use of the same metaphorical expression in different parts of a text – and *recurrence* – different metaphorical expressions related to the same source domain appearing in different parts a text – may contribute to the overall internal coherence of a text (Semino 2008: 23).

A related notion is that of *metaphorical cluster*. Metaphorical clustering entails the concentration of metaphorically used words in particular portions of a text. The notion of ‘metaphorical density’ is, however, somewhat arbitrary, since it would require a definition of what constitutes a ‘normal’ density of metaphors in a particular text type or stretch of discourse. Semino (2008: 24) refers to a study carried out by Cameron and Stelma (2004), who found that in a corpus of oral data the average density of metaphorically used words ranged between 27 and 107 per 1,000 words. Semino provides the following example of a cluster with a high density (9 out of 26 words or 350 words per 1,000) of metaphorically used words from different source domains:

And I *fought* it for a *long* time and I wanted to get *kick-started back to where* I was before, because I *felt under a cloud* (Semino 2008: 24).

What is interesting is that the clustering of metaphors can serve rhetorical purposes. In the press, for instance, articles often display a high metaphorical density in the lead to frame the topic under discussion and at the end to condense the issues presented in a persuasive way (Koller 2003a, Semino 2008: 24-25).

A related phenomenon is *extension*, which occurs when “several metaphorical expressions belonging to the same semantic field or evoking the same source domain are used in close proximity to one another in relation to the same topic, or to elements or the same target domain” (Semino 2008: 25). Again, it could be argued that there is a degree of arbitrariness in determining the number of metaphorical expressions needed to constitute an extended use of metaphor. Here I follow Semino, who uses the term when there is a minimum of two metaphorical expressions in two different phrases. These metaphorical expressions should be drawn from the same source domain to describe the same target domain (Semino 2008: 25). Consider Semino’s example below:

The Tories start their conference ... desperately *sick* – and tired. Leading lights in the party are *crippled* by *life-threatening anaemia*, *loss of appetite* and *delusions of grandeur*. Troops have been *laid low* by the Ukip *superbug*, which devastated the Hartlepool byelection and threatens to *spread* its *spores* nationwide (Trevor Kavanagh, *The Sun*, 4 October 2004, quoted in Semino 2008: 25).

In this extract, metaphorical expressions from the source domain of ILLNESS are applied to describe the performance of the Conservative Party during a national conference held in 2004. The underlined metaphorical expressions are not the only ones in the fragment, in which another pattern is present: the *combination and mixing of metaphors*. Semino (2008: 26-27) notes how ‘troops’ is set in combination with the ILLNESS scenario producing a compatible and more complex scenario, that of critically ill soldiers corresponding to the party members.

Literal-metaphorical oppositions: in certain contexts some aspect of the target domain or the topic under discussion in a text may motivate the metaphorical expression. Koller (2003b) named this manifestation topic-triggered metaphor. The following headline from an article in *The Guardian* is illustrative of this particular pattern:

America’s corn farmers *high and dry* as hope *withers* with their harvest¹¹

¹¹ From *The Guardian*, 22 July 2012. Available at: <http://www.theguardian.com/environment/2012/jul/22/americas-corn-farmers-dry-harvest>

This article reports on a drought that affected the plantations of maize in America's corn belt in the summer of 2012. In the headline the expression *high and dry* and *withers* evoke metaphorical and basic meanings simultaneously and appear to be motivated by the topic under discussion. In this way, *high and dry* has the idiomatic meaning of being in a difficult and unpleasant situation but it also evokes the picture of the fully grown maize plants standing in a drought-ridden plantation in the Midwestern United States. Similarly, the expression *withers* relates to the farmers' diminishing hopes in their difficult situation while evoking the literal withering of the crops hit by the drought. Semino notes that the concept of topic-triggered metaphor in certain contexts should be broadened to what she calls situational triggered metaphor (Semino 2008: 105). This would be the case of metaphorical expressions which are motivated by "an aspect of the communicative situation, such as place, time, addresser or addressee" (Semino 2009: 221). The author mentions, for instance, an advertisement for an energising drink, Lucozade, which was placed on billboards at UK's motorway service stations in 2007. The slogan read: REFUEL YOUR CAR. REFUEL YOUR SELF. Semino argues that although the advertisement could have worked in another context, the 'refuelling' metaphor was chosen because of the physical location of the advertisement (Semino 2009: 225).

Metaphorical expressions can also be accompanied by signalling devices which may serve to draw attention to the metaphorical nature of an expression or presumably to guide the readers' interpretation of a given expression (Semino 2008: 27). These clues include expressions such as 'metaphorically speaking', 'as it were', 'so to speak', 'sort of' and the use of scare quotes.

The above-mentioned patterns are by no means an exhaustive list of the different ways in which metaphor reveals itself in communication (see also Goatly 2011: 271-303) but are those that have proved most useful for the current study.

4.3.2 Metaphor and function

Discourse approaches to metaphor have paid increasing attention to the various functions metaphors can perform in texts. While in general it is often possible to ascribe

dominant functions to metaphors in particular domains, i.e. persuasion in political speeches or explanation in educational texts, metaphorical expressions tend to perform a number of roles simultaneously (Semino 2008: 32, Goatly 2011: 154). For instance, Semino has shown how in educational texts metaphorical expressions may, in addition to the obvious pedagogical function, also serve humorous and persuasive purposes (Semino 2008: 125-130).

Goatly (2011: 153-177) is often used as a point of departure when accounting for the functions of metaphor in language (Koller 2004, Semino 2008, Semino *et al.* 2013). He provides a detailed and illustrated account of some of the roles that metaphor can take on in communication (see table 4.1).

Table 4.1 Relationship between Goatly’s functions of metaphor and Halliday’s metafunctions

	Function of metaphor ¹²	Metafunction
1	To fill lexical gaps	ideational
2	To explain or constitute theories or models	ideational
3	To reconceptualise experience	ideational
4	To persuade or argue by analogy	ideational - interpersonal
5	To insinuate ideology	ideational - interpersonal
6	To express or induce emotion	interpersonal
7	To serve as a strategy	interpersonal
8	To cultivate intimacy	interpersonal
9	To achieve humorous or puzzling effects	interpersonal
10	To call for action	interpersonal
11	To create a fictional or poetic world	interpersonal - textual
12	To structure a text	textual
13	To enhance memorability: foregrounding and informativeness	textual

Goatly mentions as many as 13 different metaphorical functions, which he relates to Halliday’s (1978) three metafunctions of communication: *ideational* – understanding the environment, *interpersonal* – acting on others in the environment, and *textual* – providing of resources to ensure that what is said is relevant and relates to text/cotext (Goatly 2011: 154). There is no room here for a lengthy discussion of the advantages and limitations of Systemic Functional Linguistics (see van Dijk 2008a: 28-55 for a

¹² I use Tseng’s (2010) reformulation in the infinitive of Goatly’s 13 functions for stylistic reasons.

general discussion of this issue), and Halliday's functional classification and terminology will not be adopted in this thesis.

In the following, I will review some of Goatly's functions which are relevant to this study and will complete his account with examples from other analysts who have looked into the discursive roles of metaphor. It should also be mentioned that there is a degree of overlapping in some of Goatly's functional categories, which is probably inevitable due to the slippery nature of language and metaphor.

A widely acknowledged function of metaphor is to fill lexical gaps when no other term is available (Goatly 2011:154-155). The process of word formation via metaphor is also referred to as catachresis in the literature. This function of metaphor becomes evident when looking at the etymology of medical terms (see Gwyn 2002: 123-124 for a list of terms). Indeed, from an etymological point of view the word 'cancer' is itself a metaphor taken from the Greek *karkinos* meaning 'crab'. Thus, in many cases, without the help of an etymological dictionary, it would be extremely hard to track the metaphoricity of a term which has become lexicalised in the language, but in other more recent examples such as the word 'mouse' or 'web' in computing, the metaphorical meaning is more evident (Deignan 2005: 23-25).

In his second group Goatly includes two different, although related functions: explanation and modelling (these two roles will be dealt with more extensively in section 4.4). Metaphor is often used for pedagogical purposes since it allows an abstract or complex phenomenon to be described in more familiar terms. For instance, electricity is often explained as water flow through a piping system, or the atom as if it were a miniature solar system (Goatly 2011: 155-156). The difference between metaphor and model is difficult to delimit but in certain fields it is necessary to draw a distinction. For our purposes, however, it is valid to treat "models as extended metaphors" (Brown 2003: 25). Goatly (2011: 156) suggests that metaphors constitute models at a basic pre-experimental level of scientific investigation where they may be used to test hypotheses and make predictions. Brown (2003) provides the example of 'protein folding', a biological process whereby proteins change their shape and configuration under certain conditions, as a scientific model:

This process is called “folding” because an analogy was seen between the change the protein undergoes and the folding of objects in the macroscopic everyday world, such as napkins or card table chairs. [...] Is “protein folding” a model? Some would agree that the term was first used merely to give a name to a new phenomenon [...] But protein folding is more than just a name for a process. As a metaphorical expression it invites us to probe the cross-domain mapping between the literal, everyday act of folding. Thus, the act of naming the process “folding” *creates* similarities. The metaphorical expression suggests the kinds of questions that lead to a more extended model (Brown 2003: 25).

Metaphors also serve to re-conceptualise experience by presenting phenomena from a different angle through the use of unconventional terms or unfamiliar categories (Goatly 2011: 158). This function is often associated with metaphors in poetry but a creative and novel conceptualisation of phenomena is by no means limited to literary metaphors. Consider the following response to a blog entry criticising the conventional militaristic conceptualisation of cancer:

I think of cancer as a dance, but one where the dancer doesn't know the steps, the music or its rhythms, or how long the dance will be; sometimes the music is kind, and the dancer finds the tempo. Unfortunately, the audience doesn't seem sure whether to clap the rhythm or watch in respectful and supportive silence.¹³

Goatly notes that metaphors can also be used to argue by analogy and suggests that this function of metaphor is similar to the use of metaphor for modelling and reconceptualisation, but explains that it aims primarily to persuade the hearer.¹⁴ He adds that when “metaphorical analogies are used as arguments to justify an action or recommendation, this emphasis on persuasion is even stronger” (Goatly 2011: 158-159). For instance, as discussed in the previous chapter, WAR metaphors in foot-and-mouth media discourse may have served to justify the needless killing of animals (Larson *et al.* 2005).

Metaphor can also be used to express and reinforce ideologies. As previously mentioned, the mapping inherent in metaphor is partial so that certain aspects of the target domain, including specific attitudes and evaluations, are highlighted while others remain hidden (Semino 2008). Goatly (2011: 161) describes the ideological function of metaphor as “the ways in which metaphors are used to construct reality as a means of maintaining or challenging power relations in society”. Immigration, for instance, is often metaphorically rendered in a way that helps to reinforce racist ideologies. Van

¹³ <http://anthonywilsonpoetry.com/2013/01/03/together-we-can-beat-war-as-a-metaphor-for-cancer/>

¹⁴ Here I do not fully agree with Goatly's classification since metaphorical expressions used as scientific models can also have a persuasive role.

Dijk (1988: 244) noted how in the Dutch press the arrival of immigration was consistently described by metaphorical expressions from the semantic field of aquatic disaster (*flow, torrent, wave*) and *invasion*. In the Netherlands, a nation often threatened by floods, aquatic metaphors are particularly effective. In another study, Santa Ana (1999) investigated the metaphorical expressions associated with immigrants in American public discourse and found that the conceptual metaphor IMMIGRANTS ARE ANIMALS governs their portrayal in the press, thus reinforcing racist ideologies.

Goatly suggests that one of the main functions of metaphor is to express or induce emotion. This role can clearly be seen in the use of metaphor in poetry but also in metaphorical swearing (Goatly 2011: 164-168). Semino and co-workers (2013) provide a neat example of the use of metaphor for the purpose of expressing emotional attitude. The author Emily Perl Kingsley wrote a short essay entitled *Welcome to Holland*, where she metaphorically conveys her experience of having a child with Down syndrome as a holiday that did not go as planned. In her essay, having a child with special needs is equated to landing in Holland when the original planned vacation was a trip to Italy. Her essay had a great impact and Semino and co-workers suggest that this success may partly be due to the expressive force of the metaphor.

The seventh function in Goatly's list could be said to be strategic. The author metaphorically explains that metaphors are sometimes used to "dress up concepts in pretty, attention-grabbing, or concealing clothes" (Goatly 2011: 168). He mentions euphemisms which are based on metaphor as an example of concealment, i.e. *fall asleep* for dying. This strategic use can also be found in advertising, where metaphor is used indirectly to make claims about a product and free the advertiser from responsibility.

Metaphorical expressions may also serve the purpose of cultivating intimacy between the user and the addressee. The use of a particular metaphor may appeal to a particular group of people, thus creating a sense of community. Semino and Masci (1996) suggest that the metaphorical scenarios in Berlusconi's ascent to politics (football, war and the Bible) may have been chosen for their particular resonance among the Italian public. In the context of classroom discourse, Cameron (2003) has shown how metaphorical expressions are used with an affective role to cultivate intimacy between the teacher and the pupils.

Metaphor can also be exploited to achieve particular humorous or puzzling effects. Goatly provides the example of a famous riddle: “What goes on four legs in the morning, two legs in the mid-day and three legs in the evening?” (Goatly 1997: 161). The riddle can only be answered and understood by arriving at metaphorical interpretations of different parts of the day morning (infancy), mid-day (middle age) and evening (old age). Topic-triggered metaphors (Koller 2003b) which involve metaphorical expressions from source domains closely related to the target domain may sometimes be exploited in newspaper headlines in a witty manner. Semino (2008: 27) illustrates the case with the headline from an article in *The Guardian* dealing with the South Africa-Morocco conflict over control of Western Sahara. The headline read ‘Diplomatic desert’. Here the noun ‘desert’ refers not only literally to the physical location of the territory under dispute, part of the Sahara desert, but also metaphorically to indicate the lack of diplomatic relationships between the two countries (Semino 2008: 27).

Metaphors have also been said to have a perlocutionary effect. As mentioned in chapter 2, it has been claimed that the war framing of cancer may encourage overtreatment under the premise that the enemy should be fought by all means necessary (Warren 1991: 41, Childress 1995: 1836, Reisfield and Wilson 2004). It has also been suggested that the conceptualisation of the human body as a machine may contribute to an increase in surgical procedures (Fleischman 2001: 486).

Metaphors can also contribute considerably to the internal organisation of a text. This effect can be achieved through lexical or conceptual cohesion provided by the use of extended metaphors and metaphor clusters, patterns already discussed in section (4.3.1). Finally, vivid metaphors may also be used to enhance memory and hyperbolic metaphors to capture the audience’s attention. This is particularly true of metaphors appearing in newspaper headlines.

This list of functions is by no means exhaustive. In addition, other functions may be identified by analysing metaphors in particular genres. In the following section the role of metaphor in scientific genres in both specialised and popular settings will be dealt with in more detail.

4.4 Metaphor in scientific and in popularisation genres

Metaphor has for a long time been perceived as an unsuitable figure of speech in the domains of science under the impression that it would lead to vague and inaccurate descriptions of reality. Traditional accounts of metaphor, which sustained that metaphorical language always had a non-metaphorical counterpart, made metaphor unwanted in science. Following this rationale, empiricist philosophers such as Locke considered metaphor inappropriate for scientific discourse, which should be concerned with the objective and trustworthy description of reality. The following quotation from his *Essay Concerning Human Understanding* is illustrative of his distrust towards figurative language:

But yet, if we would speak of things as they are, we must allow that ... all the artificial and figurative application of words eloquence hath invented, are for nothing else but to insinuate wrong ideas, move the passions, and thereby mislead the judgment, and so indeed are perfect cheat (Locke, Book 3, Chapter 10, p. 105, quoted in Goatly 2011: 1).

However, in recent decades several authors have shown that metaphor does play an important role in the making of science (Kuhn 1993, Giles 2008, Brown 2003) and in scientific discourse (Reynolds 2007, van Rijn-van Tongeren 1997, to name just a few). Such contributions are the result of the shift from traditional accounts of metaphor – whereby metaphor was conceived as an ornamental or literary figure of speech – towards a cognitive conception of the trope (Lakoff and Johnson 1980).

Studies on scientific rhetoric have acknowledged that metaphors are highly useful for scientists to conceptualise and to account for the relations between phenomena (Ciapuscio 2005). Max Black (1993) argued that the use of metaphor can sometimes lead to the generation of new knowledge and insights and that in some cases they can help constitute scientific theories. He also warns that the selection of a particular metaphor leads to the adoption of a particular perspective, with the associated features of highlighting and obscuring. Thus, metaphors can advance as well as limit our thinking. Therefore, in relation to scientific writing, the adoption of a particular metaphor in detriment of another is of especial significance, as each of them will throw a different light on to a particular phenomenon. But the use of metaphor in science goes beyond the development of scientific theories:

The fact that metaphor is so inextricably a part of the fabric of science also means that it plays many roles. Scientists use metaphorical reasoning to interpret observational data, creating models to account for new observations and to reinterpret older data. Metaphors, once created and put to use in these ways, serve in communication between scientists and between scientists and the public. Such communication depends on explanatory language that conveys the essential ideas with clarity. A good metaphor can also be persuasive. Selling a new idea and receiving credit for it are important for the scientist's goals of achieving recognition (Brown 2003: 185).

In the hospital context, in doctor's in-group conversation, the participants also use a considerable number of metaphorical expressions to talk about illnesses. Gwyn (2002) claims that the purpose of these expressions is twofold: they project a positive social identity through the manifestation of detached irony and also, when used in a teaching hospital, they prevent patients still unaware of their diagnoses from finding out the nature of the disease they have. So *neoplasm* or *space occupying invasion* are used to talk about cancer, *acid fast infection* for tuberculosis and in acute pericarditis the appearance of the affected pericardium in surgery or at autopsy has led to the expression *bread and butter* pericardium (Gwyn 2002: 123).

Although the functions of metaphor have been dealt with in section (4.3.2), in the following the roles of metaphor in science and popularisation articles will be examined in more detail.

Scientific metaphors were classified by Boyd in a now classical chapter published in the *Metaphor and Thought* compilation (Ortony 1993). The author distinguished between two different categories of metaphors: exegetical or pedagogical on the one hand, and theory-constitutive on the other. Boyd defines the former as follows:

Exegetical or pedagogical metaphors play a role in the teaching or explication of theories which already admit of entirely adequate nonmetaphorical (or, at any rate, less metaphorical) formulations. I have in mind, for example, talk about "worm-holes" in general relativity, the description of the special localization of bound electrons in term of an "electron cloud", or the description of atoms as "miniature solar systems" (Boyd 1993: 486).

In turn, theory-constitutive metaphors are:

Those in which metaphorical expressions constitute, at least for a time, an irreplaceable part of the linguistic machinery of a scientific theory: cases in which there are metaphors which scientists use in expressing theoretical claims for which no adequate literal paraphrase is known. Such theories are *constitutive* of the theories they express, rather than merely exegetical (Boyd 1993: 486).

Boyd illustrates theory-constitutive metaphors with an example drawn from the field of cognitive psychology, where terminology from computer science abounds. Computer metaphors have not only provided the field of cognitive psychology with lexis, but also allow predictions to be made about the theory, hypotheses to be proposed and so on. According to Boyd, if the brain is seen as a computer, then thought becomes a kind of ‘information processing’, it suggests that certain cognitive processes may be ‘pre-programmed’ and it makes predictions about the ways in which things are memorised since information may be ‘encoded’ or ‘indexed’ in a ‘memory store’ by ‘labelling’ and certain types of information may be ‘stored’ in ‘images’. In addition, it raises issues concerning whether an internal ‘brain-language’ exists or whether consciousness is a ‘feedback’ phenomenon (Boyd 1993: 486). The fact that there are no literal paraphrases for the above-mentioned terms is taken by Boyd as evidence that these metaphors are theory constitutive (1993: 487). He also claims that theory constitutive metaphors are made to be overused by the scientific community.

Recent studies have shown that these two types of metaphor do not constitute separate and bounded categories and that it is more appropriate to talk about the different ‘functions’ that metaphors can perform, this being motivated by the context in which they appear (Knudsen 2003; 2005, Semino 2008; 2011). For instance, Knudsen (2003) in a case study of the metaphors used in the description of the genetic code and protein synthesis, showed how the same metaphors could be used with both a theory-constitutive and a pedagogical role. The role of the metaphor depended on the genre and context of use, a point that has also been made by Semino (2008):

It is of course possible for a metaphor to be used only for pedagogical purposes, or only for theory-constitutive purposes. However, it is often the case that the ‘same’ metaphor may have a primarily theory-constitutive function in one context and a primarily educational function in another, or may perform both functions at the same time. In addition, these two main functions of scientific metaphors can co-exist with other functions, such as argumentation, persuasion, vividness, humour and so on (Semino 2008: 134).

The change of genre also affects the kind of manifestation of the scientific metaphor and the roles that they can play; “there are often differences, however, in the specific ways in which metaphors are used, in terms of linguistic realization, textual function and the use of material from the source domain” (Semino 2008: 141).

Skorczynska and Deignan (2006), who carried out a contrastive analysis between scientific and popular business discourse, concluded that the writers' use of metaphors was influenced by the text's target audience and its purpose. They found that there was a wider range of source domains in the popular business corpus. In addition, when source domain matched in the scientific and popular corpus, the metaphorical expressions were different.

The linguist Ciapuscio (2005) has examined the persistence of metaphor at different stages of science communication. She also notes that the discursive context marks the specific functions that metaphors perform. The author provides an example of an oral interview between an expert and a science journalist and the subsequent popularisation article that the journalist wrote up. The interview deals with the activation of a virus which appears to be responsible for Kaposi's sarcoma. Ciapuscio explains that the function of the metaphors in the interview is not only to facilitate the journalist's understanding, but also to guide the specialist in the research process. In the popularised piece, the journalist draws on the metaphorical scenario provided by the specialist and creatively elaborates it. In another example, the author shows how metaphorical expressions can be used to summarise and condense complex biological processes. She highlights the flexibility of metaphorical expressions which can easily be adapted to the recipient and the specific discursive context.

In another study (2011), Ciapuscio explored the metaphorical expressions in a number of written and oral scientific genres (research articles, interviews, conferences and press popularisation articles). She identified three major functions that metaphorical expressions perform: denominative, descriptive and explanatory or argumentative. These functions are a simplification of those of Calsamiglia and van Dijk (2004) and Cassany *et al.* (2000) presented and commented on in section (3.4).

Other studies have approached the study of metaphors in popularisation discourse from a more critical perspective. As previously discussed, metaphors are seldom neutral and may, therefore, entail implicit or explicit evaluations of a given phenomenon. Popularisation discourse is a suitable arena to explore the implications of metaphors because it is where non-experts learn about scientific issues which may have implications in their daily lives.

Pramling & Säljö (2007) conducted a study on the metaphors of genetics in two Swedish popular science magazines. They were interested not only in which metaphors are used in the popularisation of genetics for the wider public, but also in the images that were being created of humans by those metaphors.

Petersen (2001) analysed Australian print news media to determine the ways in which the stories of genetics and its medical applications were framed. He suggests that metaphors such as ‘puzzle’, ‘riddle’, ‘code’, ‘book’, ‘map’, ‘decoding’, ‘code-breaking’ and ‘map making’ lend “credence to the view that scientific research is an objective search for an underlying reality; an incremental uncovering of facts” (Petersen 2001: 1261). He concluded that general news stories emphasised the medical benefits of genetic research. The author criticises the fact that there is little questioning of the actual worth of specific lines of genetic research, whether the research will be able to meet the expectations raised and whether the funding allocated for the study might have proved useful in other areas (Petersen 2001: 1264).

4.5 Summary and discussion

This chapter has provided a broad review of the field of metaphor research. As argued, the understanding of metaphor has changed significantly in recent years. Metaphor had traditionally been treated as a superfluous device which could be disposed of in language. The cognitive turn, marked primarily by the publication of Ortony’s edited volume *Metaphor in Thought* (1979) and Lakoff and Johnson’s revolutionary *Metaphors We Live By* (1980), and the subsequent development of Conceptual Metaphor Theory emphasised, on the contrary, that metaphor is ubiquitous and essential both in language and thought. While illuminating, this theory has been criticised for taking the attention away from actual language. As a result, scholars from a discourse and applied linguistic perspective have advocated the study of metaphor in real contexts of usage.

Against this background, the present thesis draws on the insights into metaphor propounded by Conceptual Metaphor Theory in terms of the ubiquity and conventionality of metaphorical expressions in language, but does not make any direct

claims on the effect of these metaphorical expressions in thought. Thus, in this thesis the approach to metaphor largely builds on the insights provided by more recent discourse-oriented studies on metaphor, in particular, those which have focused on the study of metaphor from a genre perspective and that have explored the multifaceted and flexible nature of the functions and patterns that metaphors exhibit in discourse.

Chapter 5

Corpus description and methodology

5.1 Introduction

The analysis of metaphor in popularisation articles poses a number of methodological challenges. In the following, I outline the data sampling procedure and the different decisions taken for the analysis of cancer metaphors in the texts.

5.2 Corpus description

In the last 30 years, computing advances have made a substantial contribution to the study of language by providing the researcher with efficient tools to analyse large quantities of naturally-occurring language. Such tools allow the identification of patterns and structures that are otherwise difficult to perceive with manual analysis.

Although the use of electronic corpora for the study of metaphor presents some challenges, metaphor studies has benefited greatly from these technological advances (Stefanowitsch 2006). Two different approaches are generally followed: the use of large general corpora for the study of metaphorical patterns in language (Deignan 2005) and the use of a specialised corpus compiled by the researcher to explore the use of metaphor in specific genres (Charteris-Black 2004, Skorczynska and Deignan 2006). The present study adopts the second approach. When analysing specialised corpora, the researcher often performs a manual analysis on a small sample of texts to extract

relevant metaphorical expressions which are then searched for in the whole corpus with the assistance of specific software.

This study was based on a bilingual English-Spanish corpus of 300 popularisation articles compiled from four different newspapers. The selected texts were formatted for semi-automatic analysis with computer software: WordSmith Tools (version 5.0; Scott 2010). This suite of tools includes a number of applications of which the most useful for the purposes of this study are WordList, Concord and the Viewer function. WordList creates alphabetical and numerical wordlists and summary statistics for a whole corpus, a subset of texts or individual texts. Concord generates concordance lines based on the key-word-in-context (KWIC) concept that allows the lexical items in the concordance list to be studied for their collocational patterning. The concordance list can be rearranged in different ways: according to text file order; centred on the different forms of the specific item (e.g. ‘advance’, ‘advances’, ‘advanced’, ‘advancing’); for a specified left or right horizon; or combinations of these. This tool also permits a selected item in a concordance line to be examined in context by clicking on the line in order to open up the complete text.

The alphabetical wordlists for the English and Spanish subcorpora were particularly useful for scanning the complete list to determine whether a subcorpus contained any further lexical items that were semantically related to those previously identified in preliminary studies (Williams Camus 2009a; 2009b; 2009c). These lists were also used to establish which forms of previously identified key words (e.g. ‘invade’, ‘invasive’, ‘invasion’) were present in the subcorpus. The summary statistics generates data both on the individual texts within a subcorpus and the corresponding overall data for the subcorpus. Of particular interest for this study were the statistics on text length.

As regards metaphor studies, one of the concordance tool’s most interesting features is the ability to eliminate concordance lines once a full concordance list has been created. This allows the analyst to first visualise an item in context to determine whether or not the item is metaphorical, and whether or not it refers to the relevant target domain. Once a definitive concordance list has been generated for the metaphorical use of the item of interest, this can be stored for future consultation and analysis.

The viewer feature provides the local context for a selected lexical item together with the complete text in which it appears, thereby allowing interrelationships between the same or different metaphors to be examined in the immediate co-text, and multiple occurrences of a given metaphorical source domain to be tracked in the whole article.

The corpus for this study consists of 300 popularisation articles focusing on advances in cancer research and management and published in four newspapers between the years 2002 and 2009. The corpus is further divided into an English and Spanish subcorpus. The English subcorpus contains 150 articles extracted from the electronic site of *The Guardian* (75 texts) and obtained from the *LexisNexis* database in the case of *The Times* (75 texts). The Spanish subcorpus includes 150 news items downloaded from the electronic sites of *El País* (75 texts) and *El Mundo* (75 texts). These newspapers were chosen because their coverage of science is extensive (in both the printed and electronic editions) and because they are widely read in their respective countries.

The reason for including several newspapers in the corpus was to obtain a fairly representative sample of how cancer knowledge is recontextualised in the educated press in England and Spain. The choice of the individual newspapers was based on their historical background and their standing in the sociopolitical and cultural context.

The Guardian is a prestigious elite English newspaper which was founded in 1821 under the name of *The Manchester Guardian*. Owned by the *Guardian Media Group*, it is politically aligned to the left. *The Times*, which was founded in 1785 under the name of *The Daily Universal Register*, is owned by the *News Corporation Group*, and ideologically supports the English Conservative Party.

El País is an elite Spanish newspaper founded in 1976 after the demise of Franco's dictatorship. Owned by the PRISA media group, it is politically aligned with the left, and is currently the newspaper with the widest circulation in Spain. *El Mundo*, founded in 1989 and owned by the Italian publishing company *RCS MediaGroup*, is the second most widely read newspaper in Spain. It is self-defined as a liberal newspaper and is politically aligned with the right.

The search for the articles focused on texts reporting scientific advances in the treatment of cancer. The web sites of three of the newspapers (*The Guardian*, *El País* and *El Mundo*) feature search engines which were used to locate articles containing the word ‘cancer’. *The Times* subcorpus was compiled with the *LexisNexis* database because access to the newspaper’s electronic site is restricted. Popularisation articles that met our criteria were downloaded and considered as eligible for inclusion in the corpus. Included as potential candidates were those articles reporting on advances in cancer knowledge: i.e. dealing with new insights into the biological understanding of cancer and/or developments in cancer therapies and management and based on:

1. Scientific studies published in prestigious journals such as *Science*, *Nature*, *The Lancet* and *The New England Journal of Medicine*;
2. Recent significant findings presented at international conferences such as the Annual Meeting of the American Society of Clinical Oncology; or
3. Other important events related to cancer, such as the award of a prize to an outstanding scientist.

Excluded from the selection process were other kinds of articles popularising aspects of cancer such as stories of personal cancer experiences, opinion articles, editorials and letters to the editor. The search for eligible articles continued for each of the four newspapers and the definitive contribution for each was established when a total of 75 articles meeting the above selection criteria was reached. Appendix A lists the articles for the complete corpus in chronological order for each newspaper. The characteristics of the corpus are shown in table 5.1.

Table 5.1 Characteristics of the Corpus

Characteristics	English Subcorpus			Spanish Subcorpus		
	<i>Guardian</i>	<i>Times</i>	Overall	<i>El País</i>	<i>El Mundo</i>	Overall
No. of articles	75	75	150	75	75	150
No. of words	41,510	42,997	84,507	53,127	56,704	109,831
Max. words	2,264	1,072	2,264	2,713	2,447	2,713
Min. words	167	152	152	206	309	206
Mean words	553†	573†	563*	708‡	756‡	732*

Mann-Whitney test: * $P < 0.001$; † $P = 0.061$; ‡ $P = 0.043$

As can be seen from Table 5.1, the Spanish subcorpus was 30% larger than the English subcorpus (109,831 vs. 84,507 running words). The individual texts ranged between 152 and 2,264 running words in the English subcorpus compared with 206 and 2,713 in Spanish. The mean length of the Spanish texts was greater than that of the English texts (732 vs. 563 words). When the two subcorpora were compared with the Mann-Whitney test, this difference was found to be statistically significant ($P < 0.001$).

For the English subcorpus, the articles in *The Times* proved slightly longer than those in *The Guardian*, although the longest article came from the latter and the shortest was published in the former. When the mean article length for the two English broadsheets was compared with the Mann-Whitney test, no statistically significant difference was observed ($P = 0.061$).

For the Spanish subcorpus, the articles published in *El Mundo* were longer overall than those in *El País*, although the longest article in the whole corpus (2,713 words) appeared in the latter. When the mean article length for the two Spanish newspapers was compared, the difference just reached the level of statistical significance ($P = 0.043$).

Despite the slight difference between the two Spanish newspapers, both subcorpora appear to display an internal consistency, and the most important result is the significant difference in average article length between the Spanish and English texts, which will have to be taken into account in any formal statistical tests (see statistical analysis below).

5.3 Metaphor analysis

5.3.1 Metaphor identification

Despite the profusion of metaphor studies over the last 30 years, the issue of metaphor identification remains a challenge for researchers and, as a result, studies are not always completely explicit with regard to the criteria employed for metaphor identification.

Recently, a unified method for metaphor identification, the Metaphor Identification Procedure (MIP), has been developed by the Pragglejaz Group (2007),¹⁵ composed of scholars with a shared interest in metaphor and a varied linguistic background including stylistics, applied linguistics and cognitive linguistics. The aim of this procedure is “to establish, for each lexical unit in a stretch of discourse, whether its use in a particular context can be described as metaphorical” (Pragglejaz Group 2007: 2). As straightforward as it may sound, as any linguist will appreciate, this is a complex challenge. Nevertheless, this method has generally served the purpose of metaphor identification in this thesis although certain adjustments were required which are commented on below. The original MIP is described as follows:

1. Read the entire text-discourse to establish a general understanding of the meaning.
2. Determine the lexical units in the text-discourse
3. (a) For each lexical unit in the text, establish the meaning in context, that is, how it applies to an entity, relation or attribute in the situation evoked by the text (contextual meaning). Take into account what comes before and after the lexical unit.
(b) For each lexical unit, determine if it has a more basic contemporary meaning in other contexts than the one in the given context. For our purposes, basic meanings tend to be
 - More concrete [what they evoke is easier to imagine, see, hear, feel, smell and taste];
 - Related to bodily action;
 - More precise (as opposed to vague);
 - Historically older.Basic meanings are not necessarily the most frequent meanings of the lexical unit.
(c) If the lexical unit has a more basic current-contemporary meaning in other contexts than the given context, decide whether the contextual meaning contrasts with the basic meaning but can be understood in comparison with it.
4. If yes, mark the lexical unit as metaphorical.

Pragglejaz (2007: 3)

¹⁵ The name of the group is an acronym formed with the initial of the first name of the members which included: Peter Crisp, Ray Gibbs, Alan Cienki, Gerard Steen, Graham Low, Lynne Cameron, Elena Semino, Joseph Grady, Alice Deignan and Zoltan Kövecses.

Although metaphor identification was mostly based on the MIP, it should be noted that the aim of this thesis was not to provide a meticulous description of all of the metaphorical expressions in the corpus. Rather, the interest lay in the use of metaphor as manifested in the selected newspapers in the recontextualisation of particular aspects of cancer, such as apoptosis, metastasis, and cancer research. Therefore, it was not necessary to apply the MIP to all of the lexical units in each text. In addition, although some studies have set out to test the suitability of this method for the analysis of metaphorical expressions in particular text types (see, for instance, Nacey 2010), an evaluation of the MIP is not a goal in the present study, but rather the method has been used as a means to an end.

For the purpose of this thesis, some of the MIP criteria, particularly for the demarcation of word boundaries, were not applied as rigorously as specified by the MIP. Since the aims of the study were to analyse the role of metaphors in the recontextualisation of cancer, certain phraseological units did not require decomposition because they function as a complete unit in the discourse. For instance, fixed collocations, such as *pave the way* in English or *abrir una puerta* ('open the door') in Spanish, were treated as single items, rather than decomposing them into three separate units as required by strict application of the MIP. For the sake of transparency, the selected metaphorical expressions will be included separately in the lists generated in the quantitative analysis.

This method also requires that a decision be made on the basic meaning for a given lexical unit, which can be problematic. *Pragglejaz* recommends the use of *The Macmillan English Dictionary for Advanced Learners* (Rundell and Fox 2002) because this dictionary is based on a large corpus of recent English texts from a variety of text types. The online edition of this dictionary was used for the English subcorpus. The demarcation of the basic meaning for Spanish words was established by referring to both the *Diccionario de Español Actual* (Seco *et al.* 1999) and the *Diccionario de la Lengua Salamanca*.¹⁶ The former was compiled 'from zero' using a large representative corpus of Spanish texts and reflects current Spanish usage. The latter is a Spanish learner's dictionary.

¹⁶ <http://fenix.cnice.mec.es/diccionario/>

However, the use of dictionaries in the identification of metaphors remains problematic because dictionaries are man-made and lexicographers have to make conscious choices when defining terms or establishing the order in which they set their definitions. Ultimately, the decisions concerning the use of a given lexical item were based on dictionary reference and contextual analysis.

A major limitation encountered with the application of MIP to my data is that it does not account for directly-expressed linguistic metaphors, that is, metaphors that involve an explicit cross-domain mapping such as A is like B:

Colin Goding, who led the research, said: “When certain genes called oncogenes are activated by mutation, they cause cancer to develop. When these are mutated, it’s like the accelerator in a car being jammed on – the cell is continuously getting instructions to divide.” (ti21)

In this example, the scientist clarifies how oncogenes function by spelling out the relationships between the source and target domain in a direct metaphor, or simile, rather than using an indirect expression. Although, such direct metaphors were infrequent in the corpus, they have also been taken into account in the analysis.

In addition to the difficulties faced with the application of the MIP, allocation of a given metaphorical expression to a source domain also proved problematic, as discussed in chapter 4. Since there is no fully reliable objective method to assign metaphorical expressions to a source domain in a systematic and undisputable way, the labels of the different source domains under which the metaphorical expressions identified in the corpus have been subsumed should be taken as orientative.

5.3.2 Deciding on what metaphorical expressions to focus on

Other significant challenges presented by this project involved the decisions concerning which metaphorical expressions to focus on and how they should be categorised and organised in relation to the objectives of the study. Preliminary studies on different aspects of cancer metaphors in popularisation articles had been carried out on smaller corpora. During my Master’s degree I conducted small pilot studies of metaphors while the corpus for this study was under development. The initial approach to metaphors in popularised articles in the English press was performed for my Master’s dissertation

(Williams Camus 2008; 2009b) on a corpus of 37 texts drawn from *The Guardian* and served to identify the range of metaphorical expressions used in the context of cancer, its treatment and advances in cancer research. A second study (Williams Camus 2009c) used the same text corpus and examined cancer metaphors in popularisations in relation to those described by van Rijn-van Tongeren (1997) for specialised articles. A third paper (Williams Camus 2009a) compared metaphors of cancer in English and Spanish in both *The Guardian* texts and a subcorpus of 34 articles from *El País*.

These preliminary studies yielded a wide array of metaphorical expressions which were subsumed under different source domains according to the aspect of cancer they were describing. Thus, expressions from the source domains classified under HUMANS, MACHINES, WAR, DETECTIVE STORY, GAME and TANGLE were found to apply to many different aspects of cancer and cancer research. It was also found that many of the source domains were only represented by a limited number of instances with the result that it was decided to extend the corpus and, as indicated above, to include another two newspapers. In view of this threefold increase in the size of the corpus envisaged for the thesis (from 71 articles to 300), it was evident that the general approach to metaphor used in the preliminary studies would prove unviable and it would be necessary to adopt a more selective approach in order to provide a more detailed and comprehensive account of specific source domains and specific aspects of cancer and cancer research. In the development of this new approach, the data obtained in those preliminary studies have proved useful in deciding on the source domains to be included and how they should be categorised and defined.

In what follows, I account for the decisions made in terms of the selection of metaphorical expressions and their organisation into source domains in the empirical chapters of this thesis.

Since the preliminary studies showed that war-related lexis was highly frequent and in view of the controversy surrounding the use of militaristic language to portray cancer, the aim of chapter 6 is to provide as complete an account as possible of how this type of language is exploited in the corpus in the representation of the disease. In this regard, it was decided to rename the source domain WAR, VIOLENCE AND AGGRESSION in order to

include certain metaphorical expressions that need not evoke a militaristic scenario, but do evoke others involving physical aggression such as sporting contests and martial arts.

The preliminary data revealed that metaphorical expressions from the source domains of COLONISATION, SEEDS and ANIMALS were employed to describe metastasis. Since this is one of 'The Hallmarks of Cancer' (Hanahan and Weinberg 2000) and is a complex process, it was decided to devote chapter 7 to the discussion of this process detailing the metaphors used to represent and explain it. In this thesis, these source domains have now been designated as the INVASION AND COLONISATION, DISSEMINATION and MIGRATION source domains. An additional group of metaphors have been subsumed under the JOURNEY source domain.

In the same way, chapter 8 aims to give a comprehensive account of the metaphorical representation of apoptosis, another complex process that, according to the preliminary data, is explained through diverse mechanistic metaphors and personifications.

Chapter 9 focuses on cancer treatments. In order to account for the metaphors employed for their portrayal in the corpus, it was found that some could be classified under the original source domains identified in the preliminary studies for the presentation of therapies, GARMENTS and FOOD AND COCKTAILS. In addition, the metaphorical expressions related to arms in this context were subsumed under a source domain designated WEAPONRY.

Although the preliminary studies indicated that cancer research was conveyed through metaphorical expressions from the source domains of MOVEMENT FORWARDS and LIGHT, for the presentation of cancer research in chapter 10, it was decided to focus on the expressions pertaining to the MOVEMENT FORWARDS source domain since they were far more numerous than the expressions related to LIGHT, which only appeared sporadically in the two subcorpora and were mostly of a highly conventional nature, especially in the English texts. Since it was assumed that the MOVEMENT FORWARDS source domain, which also covers more specific scenarios of EXPEDITION and RACE, would be sufficiently large to give a representative account of cancer research, it was decided not to include those metaphors pertaining to the source domains of GAMES, TANGLES and

DETECTIVE STORIES that were identified in the preliminary studies (Williams Camus 2009a; 2009b).

A number of metaphorical expressions included in the preliminary studies in the source domain of DIRT and under the heading of mythology and folklore images have been reclassified into other source domains where necessary. Thus, based on the contextual analysis, the euphemistic expression *mop up* was included in the WAR, VIOLENCE AND AGGRESSION source domain, as were the *Achilles' heel* and *Trojan horse* metaphors in view of their evident militaristic connotations.

5.3.3 General analytical procedure

The procedure followed for each of the empirical analyses for chapters 6 to 10 basically consisted of three stages which were adapted according to the specific requirements of each topic. The following description relates to the analysis of the WAR, VIOLENCE AND AGGRESSION source domain.

1. **Location of relevant metaphorical items.** Wordlists were generated with the WordList tool and the alphabetical list was scanned to check for the presence of lexical items (e.g. *invade*, *invader*, *invasive*), as identified in the preliminary studies and to locate other potential candidates for exploration.
2. **Concordances.** Concordance lists were generated for the lexical items, either individually or in groups by using the asterisk feature whichever was most convenient, and these were viewed in context in order to (1) establish metaphorical use as opposed to a more basic meaning; and (2) establish that the expression referred to the aspect of cancer under study as opposed to any other unrelated domain. The concordance lists were then refined by eliminating those concordance lines not relevant to the analysis. Viewing in context also allowed other related metaphorical items to be identified that could then be targeted in other searches in the subcorpus under examination.

This process was repeated for all the lexical items identified until the process yielded no further additions to the analysis. A reading of a hard copy of each article marking the metaphors in the text was then carried out to confirm that all the metaphors of interest for the analysis had been included.

3. **Compilation of definitive lists.** Definitive lists of the relevant metaphorical expressions for each newspaper and subcorpus were then compiled in order to carry out the quantitative and qualitative analyses. The quantitative analysis, especially in the case of the WAR, VIOLENCE AND AGGRESSION source domain, served to identify suitable articles to use as sample texts in the qualitative analysis.

For the chapters dealing with the specific biological processes of metastasis and apoptosis, the procedure was slightly modified. In stage 2, additional searches were conducted for the specific scientific terms (e.g. *metast**, *metást**, *second**, *segund**, and *spread**) to identify texts that specifically dealt with the topic. The co-text was then examined to determine if any metaphorical expressions of interest were present other than those already identified from the alphabetical lists or in the preliminary studies. In chapter 9, similar searches were conducted for specific treatments such as chemotherapy, radiotherapy, targeted treatment etc. For chapter 10, the general process was followed starting from the lexical items identified in the preliminary studies.

5.3.4 Quantitative and statistical analysis

In the quantitative analyses, tables were constructed including all the metaphorical expressions for a given source domain for each of the newspapers and each subcorpus. When these tables were extremely long, as in the case of the WAR, VIOLENCE AND AGGRESSION source domain, the full tables have been included in Appendix B (tables B.3 and B.4) and the metaphors have been summarised for presentation in the text. For the summarised data, the linguistic variants were grouped under the most frequent form (e.g. under *aggressive* are subsumed *aggression*, *aggressiveness*, and *aggressively*) and only those metaphors appearing at least three times in a subcorpus and in at least two

texts were included in these summary tables. The quantitative data are presented as natural numbers (occurrences) and percentages, when appropriate.

Formal statistical tests were carried out when the quantitative data was sufficient to allow this type of analysis to be performed. This was possible in the case of the data for the texts included in the corpus and for the analysis of the WAR, VIOLENCE AND AGGRESSION source domain. Linguistic data rarely exhibit a normal distribution (Gaussian distribution), often because the data set includes zero values, as occurred with the data for metaphors, or presents a few extreme values, or outliers, as occurred in the data on the text corpora. In such cases, the appropriate statistical tests are non-parametric tests. To compare the relative frequency of use of the WAR, VIOLENCE AND AGGRESSION metaphors, texts were classified as having zero frequency, low frequency (1-3 metaphors), intermediate frequency (4-9 metaphors) or high frequency (10 or more metaphors). For this categorical variable, the χ^2 test was used to compare the pairs of newspapers within each subcorpus and to compare the English and Spanish subcorpora. For continuous variables, as was the case of the mean text length (see table 5.1 above) and metaphor density, the Mann-Whitney test was used to compare the newspaper pairs and to compare the English and Spanish subcorpora, and the Kruskal-Wallis test was used to compare all four newspapers. Since the mean number of words in the Spanish texts was greater than in the English articles, the number of metaphors in the WAR, VIOLENCE AND AGGRESSION source domain was normalised and expressed as an index per 1,000 words. This was calculated by dividing the number of metaphors by the number of words in the text and multiplying by 1,000. The statistical analyses were performed with the SPSS version 20 (Statistical Package for the Social Sciences: IBM Corp., USA), and the level of significance was set at $P \leq 0.05$.

5.4 Summary

The present chapter has described and characterised the corpus used in this study, which consists of 300 popularisation articles from the English and Spanish press focusing on advances in cancer research and management. This chapter has also outlined the methodology used for this investigation, which combines computer assisted and manual

quantitative and qualitative analyses. The identification of metaphorical expressions was carried out with an adapted version of the MIP. For each of these aspects of the material and methods, I have discussed the difficulties involved and justified the personal decisions and choices that I have made in the context of the present dissertation.

Chapter 6

The WAR, VIOLENCE AND AGGRESSION source domain

6.1 Introduction

As argued in chapter 2, since the publication of Sontag's *Illness as Metaphor* (1978), studies on cancer discourse have paid special attention to the use of expressions from the lexical reservoir of war. Most of these works have discussed whether such figurative language is appropriate for describing the disease, or whether it may harm the sensitivity of the patient. Without losing sight of this ongoing debate, in this chapter I venture beyond the discussion of the (un)acceptability of bellicose language to explore the patterns and functions of these metaphorical expressions in the corpus of press popularisation articles.

Although researchers often refer to the 'war on cancer' or to the WAR source domain when analysing cancer discourse, here I use a more flexible label since a number of metaphorical expressions do not necessarily relate to war proper but to violence or physical aggression more generally (Ritchie 2003, Semino 2006; 2008). I have, therefore, named the source domain WAR, VIOLENCE AND AGGRESSION (WVA).

This chapter is organised as follows. Section (6.2) provides a general quantitative and statistical analysis of the concentration of metaphorical expressions from the WVA source domain in the corpus. The in-depth analysis of each of the pair of languages analysed here is presented separately. Section (6.3) includes the analysis of the English subsection and is structured into three parts: (6.3.1) provides a quantitative analysis of the WVA source domain. In this first section, I also discuss some of the decisions that

needed to be adopted in the selection of the metaphorical expressions in the subcorpus. (6.3.2) illustrates the different patterns of the metaphorical expressions with examples from the English articles and (6.3.3) includes a detailed analysis of a sample text in which expressions from the WVA source domain are particularly exploited. In turn, section (6.4) provides the results from the Spanish subcorpus and is also further divided into three subsections: (6.4.1) provides the quantitative analysis; (6.4.2) gives examples of the various patterns exhibited by the metaphorical expressions and the functions they perform; and (6.4.3) provides a detailed analysis of a sample text from the Spanish subcorpus. Finally, section (6.5) summarises the main findings of this chapter.

6.2 WAR, VIOLENCE AND AGGRESSION – Quantitative analysis

Table 6.1. shows the data pertaining to the quantitative analysis. The details on the number of running words and mean text length are repeated from table 5.1 for convenience. The English subcorpus contained 946 metaphorical expressions from the WVA source domain, of which 411 were present in *The Guardian* and 535 in *The Times*. The Spanish subcorpus presented a total of 775 metaphorical expressions from the WVA source domain, with 428 appearing in *El País* and 347 in *El Mundo*. The mean number of WVA metaphors per text is 6.31 in the English subcorpus (5.48 in *The Guardian* and 7.13 in *The Times*); the corresponding mean for the Spanish subcorpus is 5.17 (5.71 in *El País* and 4.63 in *El Mundo*). Thus, the English subcorpus mean is not much higher than the Spanish mean and the means for the individual newspapers are seen to overlap. However, these figures do not take into account text length. Since the Spanish subcorpus is larger than the English subcorpus and, therefore, the average length of each Spanish article is also greater (732 vs. 563 words), the formal comparison of the WVA metaphors between the subcorpora and between the newspapers within each subcorpus was based on a normalised index of metaphor density expressed per 1,000 words. This was calculated by dividing the number of WVA metaphors in each text by the text length in words and multiplying by 1,000. The resulting indices (see Appendix B: tables B.1 and B.2) were then compared with the Mann-Whitney test. This analysis showed that the mean index of metaphor density of the English subcorpus (12.14) is significantly higher than that of the Spanish subcorpus (7.50; $P < 0.001$).

Table 6.1 Quantitative comparison between and within the English and Spanish subcorpora

Characteristics	English Subcorpus			Spanish Subcorpus		
	<i>Guardian</i> n = 75	<i>Times</i> n = 75	Overall N = 150	<i>El País</i> n = 75	<i>El Mundo</i> n = 75	Overall N = 150
No. of words	41,510	42,997	84,507	53,127	56,704	109,831
Mean words	553	573	563	708	756	732
War metaphors	411	535	946	428	347	775
Mean metaphors (range)	5.48 (0 – 21)	7.13 (0 – 24)	6.31 (0 – 24)	5.71 (0 – 23)	4.63 (0 – 38)	5.17 (0 – 38)
Mean index per 1000 words	11.07 †	13.19 †	12.14 *	8.71 ‡	6.28 ‡	7.50 *

Paired comparison with the Mann-Whitney test: * $P < 0.001$; † $P = 0.073$; ‡ $P = 0.007$

For the analysis of metaphor density in the different newspapers, all four newspapers were first compared with the Kruskal-Wallis test. This analysis showed a statistically significant difference between them overall ($P < 0.001$). When paired comparisons between newspapers were performed with the Mann-Whitney test, the analysis revealed a significantly lower mean density in *El Mundo* than in *El País* (6.28 vs. 8.71, respectively; $P = 0.007$) whereas there was no difference in metaphorical density between *The Times* and *The Guardian* (13.19 and 11.07 respectively; $P = 0.073$).

Thus, the English subcorpus shows greater consistency in metaphorical density than the Spanish subcorpus, and overall the English texts contain a higher concentration of the metaphors belonging to the WVA source domain than the Spanish texts.

6.3 Analysis of the English subcorpus

6.3.1 Quantitative analysis and metaphor selection

Table 6.2 summarises the metaphorical expressions identified under the WVA source domain in the English subcorpus. The table includes the basic semantic concepts underlying the metaphorical expressions found in the English subcorpus three or more times and in at least two different texts. When two or more related forms appear in the corpus (e.g. *aggressive*, *aggression*, *aggressiveness*), table 6.2 shows the form with the highest frequency. The full list of metaphorical expressions can be found in Appendix B (table B.3).

Table 6.2 WAR, VIOLENCE AND AGGRESSION metaphors in the English subcorpus

	<i>The Guardian</i>	<i>The Times</i>	Total		<i>The Guardian</i>	<i>The Times</i>	Total
Target	53	107	160	War	2	6	8
Kill	46	62	108	Beat	4	3	7
Attack	26	37	63	Achilles' heel	2	4	6
Destroy	19	41	60	Hit	1	5	6
Fight	28	28	56	Stealth	4	2	6
Aggressive	31	22	53	Battle	2	3	5
Block	24	19	43	Blunt instrument	1	4	5
Damage	13	26	39	Burn	3	2	5
Resistance	17	17	34	Combat	4	1	5
Suppress	17	12	29	Guard	3	2	5
Invade	8	10	18	Knock out	1	4	5
Weapon	13	4	17	Wipe out	4	1	5
Defence	7	9	16	Aim at	4	0	4
Harm	10	4	14	Arsenal	4	0	4
Strategy	3	11	14	Bomb	1	3	4
Bullet	4	7	11	Bust	2	2	4
Launch	2	9	11	Home in on	2	2	4
Eliminate	3	7	10	Win	2	2	4
Force	6	4	10	Mop up	1	2	3
Starve	2	7	9	Strike	1	2	3
Eradicate	4	4	8	Zap	2	1	3
Front	0	8	8				

It should be noted that of the ten most frequently used metaphorical expressions five are characteristic of scientific discourse concerning cancer: *target*, *aggressive*, *block*, *resistance* and *suppress*. The remaining five are general expressions within the semantic field of violence: *kill*, *attack*, *destroy*, *fight* and *damage*. The ten most frequent expressions account for 68% (645 of 946) of the total number of WVA metaphorical expressions.

6.3.2 Intricacy of the WAR, VIOLENCE AND AGGRESSION source domain

As can be seen from table 6.2, the linguistic metaphors from the WVA source domain are numerous and varied. The multiplicity of the relations between the different metaphorical expressions within this domain are shown in figure 6.1. The figure is centred on *war* and includes almost all of the basic nominal manifestations together with a number of adjectival and verbal representations; most of the related verbs and synonyms are presented around the border.

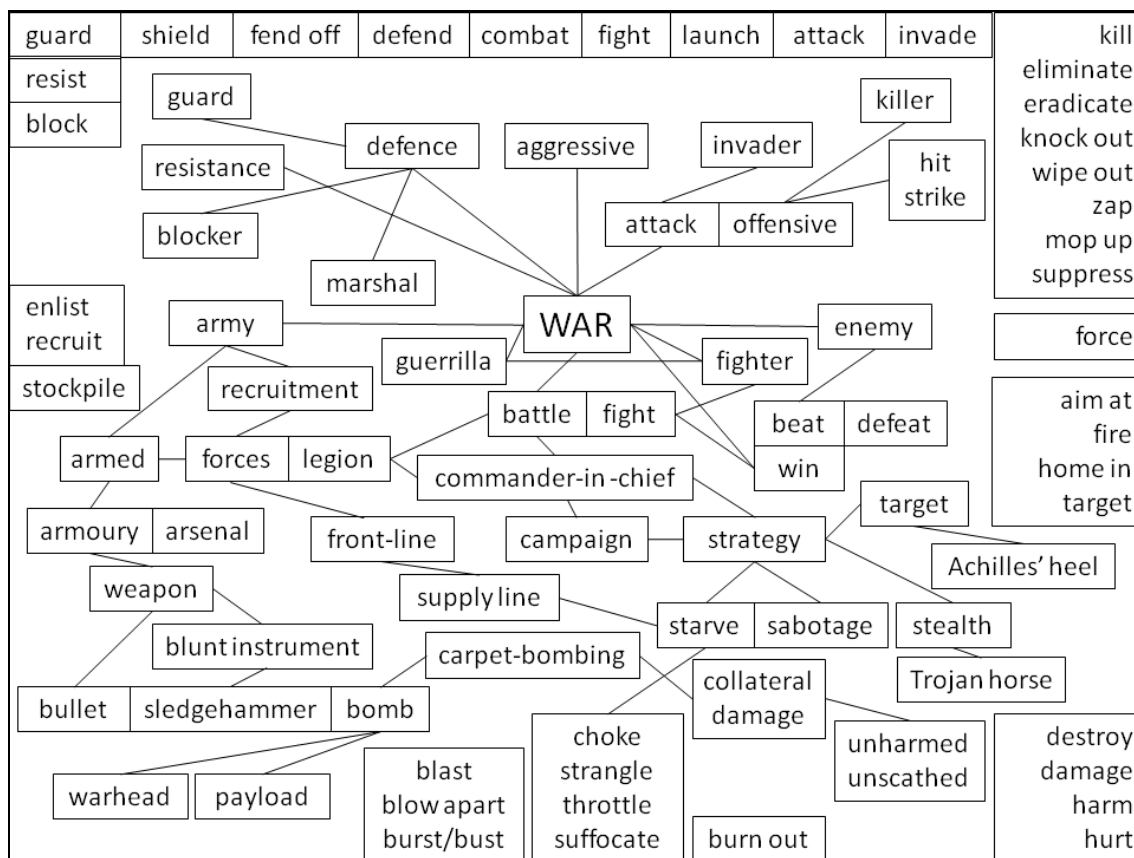


Figure 6.1 Relationships between metaphorical expressions in the WAR, VIOLENCE AND AGGRESSION source domain

Generally speaking, the metaphorical expressions identified in the English texts present a scenario of confrontation between opposing forces, with the scientists, doctors, patients, the drugs, and the immune system on one side and cancer on the other. Thus, in the texts, cancer is fought at different levels (Stibbe 1997). Groups of scientists, who are *armed* (1) with knowledge, may join *forces* (3) with other groups or institutions against their common *enemy* (2). They have at their disposal the full *force* (2) of a *legion* (1) of developments, as well as individual cancer *fighters* (1) and *armies* (2) of patients and *killer* T-cells (1) to deal with the formidable *killer* (15).

The global concept of *war* is relatively infrequent in the English subcorpus, appearing only 8 times. Despite this rarity, the militaristic scenario is evoked by other related expressions at a lower level of generality, such as *battle* (5), *to combat* (5), *campaign* (2), or *guerrilla* (1) but the most numerous expressions at this level are those derived from the lemma¹⁷ ‘fight’: *fight* (12), *to fight* (35), and *fighting* (8). The high frequency

¹⁷ Here lemma is defined as a headword comprising different word classes (Koller 2004: 221).

of this last set of expressions may be due to the fact that they are not specific to the military context since they can also refer to other scenarios which involve confrontation or aggression as in sporting contests like the martial arts or boxing (Ritchie 2003).

Owing to its complexity, the confrontation is presented as a planned undertaking in which a number of *strategies* (12) come into play. Patients are *enlisted* (1) or *recruited* (6) to enter in trials *launched* (9) to *beat* (7) the disease through different *strategic* (2) actions that are carried out on a number of *fronts* (4) or *frontlines* (4). Within the body, different biological entities are also *recruited* (2) on both sides of the conflict. During the confrontation, certain components of the immune system may *marshal* (2) others in an *offensive* (1) against cancer cells, or chemical compounds may be employed in an attempt to *sabotage* (1) tumour formation. After the confrontation, the immune system may also assist in the *mopping up* (3) of malignant cells.

Within this scenario cancer therapies and treatments are presented or explained by drawing on the semantic field of weaponry. The conventional therapeutic *armoury* (2) is reliant on three rather *blunt instruments* (5): chemotherapy, radiotherapy and surgery, which are of an *aggressive* (7) nature and are not always as precise as desired, causing *collateral damage* (3) to the body's healthy cells. Efforts are being made to replace these *carpet-bombing* (1) tactics with an *arsenal* (4) of sophisticated *weapons* (17) that will *target* (24) the *aggressive* (45) cancer cells while leaving healthy cells *unharmed* (7). Innovative solutions are being developed by building on the growing knowledge gathered from the Human Genome Project and may add to the current *stockpile* (2). Such developments include drug-filled *warheads* (1), (smart) *bombs* (3), special *bullets* (11) and nanoparticles that release their *payload* (2) onto the cancer cells leaving healthy tissue *unhurt* (1) or *unscathed* (1). Some experts, however, remain sceptical and believe that no *magic bullet* will ever be developed to treat cancer.

The mutual actions of the different agents involved in the conflict are conveyed through an array of verbs (and related derivations) expressing violent activity and its effects. In this regard, recurrent lexical sets were *attack* (verb 53; noun 10) and *destroy* (verb 50, *destruction* 3; *self-destruct* 3; *destructive* 3). The verb to *kill* is highly recurrent in the corpus with (76) instances, *kill off* (10). Other less frequent synonyms include *knock out* (5), *zap* (3) and more euphemistic verbs: *eliminate* (10), *eradicate* (8), *wipe out* (5).

In other contexts in which the focus is placed on a cancer's particular weakness, treatments *aimed at* (4) the tumour's *Achilles' heel* (6) were conveyed through specific forms of violent action that indicate the manner in which the killing was carried out: by *starving* (9) the tumour, or with the group of semantically related verbs *choking* (1), *throttling* (1), *strangling* (1) and *suffocating* (1). In some isolated examples it was the patient that was said to have been *hit* (6) or *struck* (3) by cancer; these verbs are also associated with other scenarios that evoke sporting contests or martial arts (Ritchie 2003).

In response to the aggressive actions of the tumour, the different agents are said to resort to a series of *defence* (14) strategies. Medication may *shield* (1) the organism from developing cancer. Certain genes may act as *guards* (3) and *guard* (2) healthy tissue against cancer cells. Other genes and drugs act as *blockers* (2) and *block* (40) various processes and mechanisms of tumour formation. Compounds in foods may also help to *defend* (2) the body by *fending off* (1) cancer. A recurrent notion is that of the cancer becoming *resistant* (20), showing *resistance* (11), or *resisting* (3) cancer treatment.

Although some of the metaphors mentioned only appear once in the corpus, the abstraction above serves to illustrate the richness and the diversity of the expressions from the WVA source domain in the English subcorpus. Within this system, numerous correspondences can be drawn between different aspects of the WVA source domain (agents; the general concept of war and its particular manifestations and strategic operations; weapons; violent actions; and defence or resistance strategies) to account for a variety of target domain features.

6.3.3 Degrees of metaphoricity

Many of the metaphorical expressions included are characteristic of specialised cancer discourse, where they are used by experts with conventional senses to refer to a given target domain (Semino 2008: 159). For instance, the lemma *target*, the metaphorical expression ranking the highest in the subcorpus, is a highly conventional metaphor in the specialised discourse of cancer. In the corpus it appears in its verbal form to *target*, nominal *target* and in the adjectival form, as in *targeted* treatment:

(1) the drug works by *targeting* a protein produced by cancers carrying the HER2 gene, which has been found to accelerate tumour growth. (ti31)¹⁸

(2) A second gene, called LMTK2 is a promising *target* for new drugs to treat the disease, the researchers said. (gu55)

(3) The discovery raises the hope of a “*targeted*” therapy which could lead to a sophisticated new age of treatments for women who test positive for FGFR1 and spare them chemotherapy, with its devastating side-effects. (gu39)

The *National Cancer Institute* defines ‘targeted therapy’ as: “A type of treatment that uses drugs or other substances, such as monoclonal antibodies, to identify and attack specific cancer cells. Targeted therapy may have fewer side-effects than other types of cancer treatments”. It appears, however, that the promise of ‘targeted’ treatments is still to be fulfilled and that the label is somewhat too optimistic (Zhukov and Tjulandin 2008, see also chapter 9). This may be why, in some instances, *targeted* appears between scare quotes in the popularisation articles:

(4) The scientists say they are now able to *home in on* the women who will respond the best. Experts believe that such “*targeting*” of cancer therapies is the future for treatment. (gu46)

The same applies to the expression *aggressive*, which in medicine has acquired a specific meaning and is used to describe both the disease and the treatment. The *National Cancer Institute* defines the term as referring to a “tumour or disease that forms, grows, or spreads quickly. It may also describe treatment that is more severe or intense than usual”. In the corpus, both uses have been identified but the former predominates:

(5) Thousands of men with *aggressive* and incurable prostate cancer could gain years of life with a ground-breaking new drug, British researchers say. (ti56)

(6) The discovery will enable doctors to screen young leukaemia patients to establish the severity of their illness and spare some the harrowing side effects of *aggressive* chemotherapy. (ti51)

A third highly conventional metaphor is *resistant*, which in oncology is applied to those cancers that do not respond to treatment. This property is also expressed through the noun in the phrase: develop *resistance*.

¹⁸ Although the examples quoted may contain other metaphorical expressions, I only highlight the metaphors of interest for the ongoing discussion in each chapter.

Though less frequent than the previous three terms, the expression *invasive* also has specific meanings in oncology, again, taken as referring both to tumours with metastatic potential (see chapter 7) and to the therapies used in cancer treatment:

(7) About 80 per cent of women with breast cancer could in theory be treated effectively with surgery and radiotherapy [...]. The other 20 per cent have a more *invasive* tumour that also requires hormone treatment and chemotherapy. (ti19)

(8) They are hopeful that the test, which will eliminate unnecessary *invasive* surgery for some patients, could be available routinely to all men with prostate cancer within five years. (gu19)

Table 6.2 also contains numerous verbs which are used to describe the actions of cancer drugs, the immune system and cancer itself. Although some of the verbs included in the table appear to be more central to, or can be more directly grouped under, the WVA source domain than others, the rationale behind the analysis was to make the selection more inclusive. Nevertheless, the choices made are spelled out, and examples to justify the inclusion criteria are provided below.

For a number of verbs identified in the corpus, such as *eliminate* and *eradicate*, the meaning ‘to kill’ is not the most basic or first meaning of the term. Nevertheless, these expressions have been subsumed under the WVA source domain since they could be said to be euphemisms. In addition, the close proximity of other more clearly metaphorical expressions¹⁹ related to the notions of violence and aggression encourages a metaphorical interpretation of the terms.

(9) They have tested *search-and-destroy* toxins, designed to make for and *eliminate* only cancerous cells. (gu22)

(10) In an accompanying article Louis Weiner [...] wrote that Yee’s work “underscores the remarkable potential of the immune system to *eradicate* cancer, even when the disease is widespread”. The case showed that hopes to turn the immune system into a *weapon* against cancer was becoming a reality, Weiner added. (gu64)

Of the euphemistic verbs, *wipe out* and *mop up* are an interesting pair because in war discourses they provide a source domain (CLEANING) for a target (WAR) that de-emphasises the violent meaning of *kill*. Nevertheless, the use of these expressions has become so conventionalised in war rhetoric that they could well be included as part of

¹⁹ Cameron and Low (2004) have suggested that some explicit metaphors may encourage a metaphorical reading of other items that may be less clearly metaphorical in isolation. These expressions can be ‘attracted’ into a metaphorical system by means of metaphorical resonance (see also Semino 2008: 26).

the lexicon of the WVA source domain, which in the context of cancer shapes the discourse.

(11) BRITISH cancer researchers have created a designer virus capable of infecting tumour cells and *wiping* them *out*, while leaving healthy cells *unharm*ed. (ti15)

(12) Fluorouracil is often given after surgery to “*mop up*” any remaining cancerous cells to prevent the tumour returning. (ti11)

Having established the quantitative presence of the WVA source domain in the English subcorpus, the intricate relationships set up between its multiple manifestations and the different degrees of metaphoricity exhibited by the linguistic exponents, the next section provides actual examples of the different ways in which expressions from this source domain are employed in the data.

6.3.4 WAR, VIOLENCE AND AGGRESSION – Metaphorical patterns

This section illustrates how metaphorical expressions from the WVA source domain are realised in actual examples from the corpus. First, a general summary is given of the distribution of the metaphorical items in the texts. As will be seen, not all of the articles in the English subcorpus make extensive use of WVA expressions. Therefore, in accounting for the potential of this metaphorical system, the discussion will focus on examples from texts displaying a particularly high number of metaphorical items.

Tables B.5 and B.6 in Appendix B detail the metaphorical expressions from the WVA source domain by text for each newspaper in the English subsection of the corpus. Contrary to initial expectations, the analysis suggests that expressions from the WVA source domain are not used extensively in all the texts from the English subcorpus.

Table 6.3 summarises the distribution of the WVA metaphorical expressions in the English subcorpus. The texts were classified as having high, intermediate or low frequency or zero. The cut-offs between categories were established arbitrarily. There was no significant difference in the frequency distribution between the two newspapers ($P = 0.102$).

Table 6.3 Comparison of metaphor frequency distribution in the English subcorpus

Frequency	<i>The Guardian</i>	<i>The Times</i>	Combined	Percentage
High (≥ 10)	13	18	31	20.7
Intermediate (4-9)	33	39	72	48.0
Low (1-3)	20	16	36	24.0
Zero	9	2	11	7.3
Total	75	75	150	100

χ^2 test: $\chi^2= 6.205$; degrees of freedom = 3; $P = 0.102$

When the two newspapers are considered together, eleven texts contain no metaphorical expressions from the WVA source domain. Of those with metaphors, approximately half show an intermediate frequency and slightly more texts fall into the low frequency category than into the high frequency group.

When the metaphorical expressions contained in the texts in the low frequency category (1-3 items) were analysed, the majority (56 of 69; 81.2%) were found to be drawn from the metaphors most frequently used: that is, items which, according to table 6.1, appeared 14 or more times. The cut-off of 14 was established since in both the English and Spanish subcorpora there was a gap in continuity between 11 and 14. Thus, these texts only included isolated examples of the less frequent and, therefore, less conventional and more creative items, including *armoury, bust, force, launch, marshal*.

In the rest of this section most of the examples discussed are taken from texts in the high frequency category which make extensive use of WVA metaphorical expressions, together with a number of particularly striking examples contained in texts in the intermediate category.

As mentioned above, explicit mention of *war* is infrequent in the English subcorpus (8 tokens; 6 texts). Whilst in three texts the scenario is evoked at some point of the article but not truly developed, texts (ti38), (gu11) and (ti05) are worthy of comment because the militaristic theme is exploited throughout.

Text (ti38) presents an interesting variation on the general theme of the war on cancer. The lead opens with a reference to Nixon's declaration of the war on cancer and acknowledges that little progress has been made because of the lack of knowledge about the enemy:

(13) PRESIDENT Nixon famously declared a *War* on Cancer in the 1970s, but cancer *won*. Little real progress was made in reducing the death toll. Understanding of cancer was then too sketchy to base a serious *campaign* on: as many *commanders-in-chief* have discovered, *launching* a *war* without the necessary intelligence is a foolhardy enterprise. (ti38)

The body of the text is formed by six short paragraphs in which the war frame is almost completely dropped, with only one reference to *resistance*. The journalist mentions two difficulties that arise in the treatment of malignant disease. Cancer is not a single disease, but many diseases and, as such, the causes of the different types are varied. Therefore, the therapeutic approaches will also have to be diversified. In addition, even though a treatment may prove effective for a given tumour, cancer cells often develop *resistance* to the treatments. In spite of this, the journalist points out that two therapies have proved effective in particular types of cancer: Glivec for the treatment of chronic myeloid leukaemia and Tamoxifen for breast cancer.

In the last paragraph, the journalist reintroduces and reformulates the WAR theme so that it captures the implications that the disease's complexity entails for the oncological approach to be adopted:

(14) So it is less a *war*, more a series of *guerrilla* actions that will chip away at the grip of cancer on humanity. (ti38)

In this closing paragraph, the *guerrilla* metaphorical expression performs a number of functions. This less conventional metaphor helps to explain the complexity of the disease by reconceptualising the approach on cancer (Goatly 2011: 158) by using a hyponym from the semantic field of WAR. In addition, it summarises the content in the body of the article in a vivid and evocative way and it structures the text into a circular narrative.

Texts (gu11) and (ti05) report on the same investigation which involved the use of a common cold virus in an animal model of brain cancer. Both newspapers report the story in a similar way and make extensive use of WVA metaphorical expressions. The two articles quote the researcher, who presented the experiments performed on mice as if it was a *war* between the cancer and the virus:

(15) “Cancer can be devious, in that it does everything to evade *destruction*. But viruses are equally tricky in their quest to *invade* cells and propagate,” said Frederick Lang, one of the investigators. “In this experimental *war* between cancer and viral therapy, the virus *won*”. (gu11)

As noted by Stibbe (1997), the war on cancer can be waged at different levels: the government, scientists, the patients and drugs. Text (ti38) is an example of war taking place at the higher level whereas texts (gu11) and (ti05) illustrate a confrontation taking place at a lower level within the body.

A common denominator of the texts showing extensive use of WVA metaphorical expressions is that they deal with innovative approaches which are at different stages of development. The rationale behind them is to deliver chemotherapeutics solely to cancer cells, thus minimising the toxicity to normal cells. For this reason, they are globally referred to as ‘targeted’ therapies or treatments. Example (16) metaphorically expresses the main *raison d’être* of these novel approaches:

(16) A *targeted* drug is a *smart weapon* that *strikes*, *seeks* and *destroys* the cancer cells without *damaging* the healthy tissue around it. (ti25)

Targeted drug delivery is still in its early days (Zhukov and Tjulandin 2008), and researchers face a number of problems which include how to get the chemotherapeutic agents to evade the immune system, to reach the cancerous cells, and to release the active components in a controlled way. However, scientists are developing innovative solutions to overcome these difficulties. Some of these novel approaches include nanotherapy, viral therapy, immune therapy, and gene therapy. The understanding of the action of these therapies involves highly complex biological knowledge. The use of metaphor, therefore, becomes a necessity to convey in a comprehensible way the biological interactions that take place within the organism. In the following I illustrate how some of these targeted therapies are metaphorically explained in the texts.

A number of texts presenting results from experiments that are looking into the application of nanotechnology in the treatment of cancer are particularly interesting. Nanotechnology involves the use of tiny materials that travel through the organism to deliver chemotherapeutics to cancer cells. Given the small size of nanoparticles, it becomes necessary to convey their action in a way that readers can ‘visualise’ how these technologies work.

Text (ti71), for instance, makes extensive use of metaphorical expressions to report on a trial with patients that will use a new therapy based on nanotechnology. The WVA metaphorical expressions in the article are numerous (20) but they are not particularly varied (*target* is used 10 times and *destroy* twice). What is interesting about the use of metaphor in this text is its exploitation of creative metaphorical expressions to convey the new therapy. The advantages presented by the nanoparticle include the selective nature of drug delivery, the evasion of the immune system and the gradual release of the therapeutic molecules. The new therapy is described as a ‘stealth smart bomb’ in the lead and this notion is creatively elaborated in the description of the action of the four elements composing the nanoparticle:

(17) It [the nanoparticle] has four elements, the first of which is its *payload*, a common chemotherapy drug called docetaxel or Taxotere.

The docetaxel molecules are enclosed in a matrix made of a biodegradable polymer known as polylactic acid, which breaks down slowly over several days so that the drug is released gradually. This means that a single injection of nanoparticles can have a long-lasting effect.

This drug-filled “*warhead*” is then covered with a “*stealth coating*” of polyethylene glycol, which helps the particle to hide so that it is not *attacked* by elements of the body’s immune system such as antibodies and macrophage cells. Normally, nanoparticles for drug delivery risk being recognised by the immune system and *destroyed*.

[...] The final element of the particle is its *smart targeting* system, in the form of special enzymes attached to the outer *coating* known as *targeting* ligands. These are designed to bind to a molecule found on prostate cancer cells called prostate-specific membrane antigen (PSMA), so that the particles accumulate at the site of tumours before releasing their drugs. (ti71)

In (17) the journalist draws from general knowledge about weapons and explosives to explain the four-layered structure and functioning of the nanoparticle (figure 6.2). The conventional chemotherapy drug (docetaxel) is depicted as the *bomb’s payload*, which is enclosed in a polylactic acid that makes sure that the drug is released slowly and diffused. Although this component could be seen as the equivalent of the *bomb’s detonator*, the parallel is not made explicit probably because this would imply sudden release of the drug. The combination of the drug and the polylactic acid is then referred to as a *warhead*, which is in turn endowed with a *stealth coating* – composed of polyethylene glycol that ensures that the particle goes unnoticed by the immune system – and a *smart targeting system* – targeting ligands that make the particle bind specifically to a site on the cancer cells.

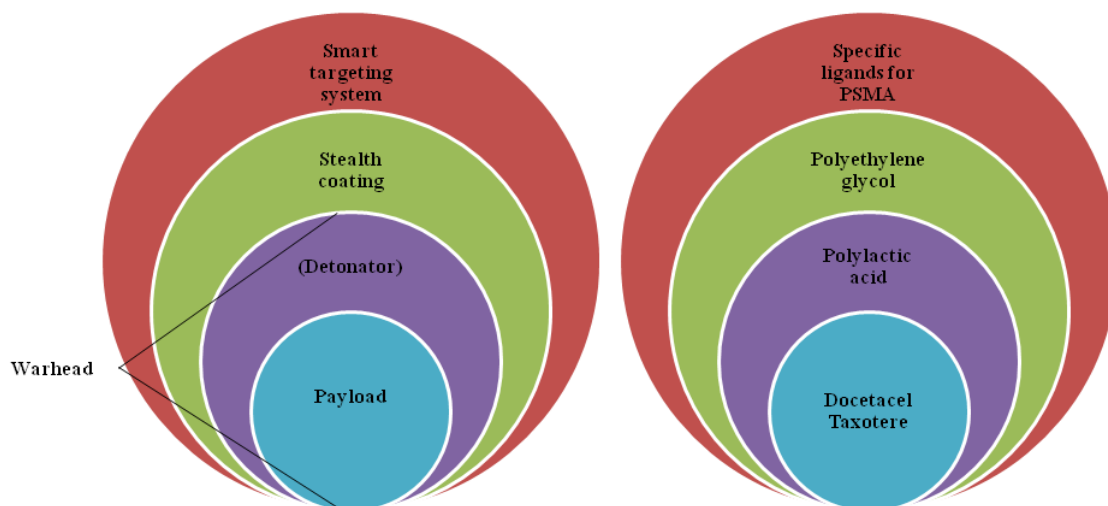


Figure 6.2 Source to target domain correspondences for *stealth smart bomb*

Nerlich (2012) studied the metaphorical framing of this story by examining the press release issued by Massachusetts Institute of Technology’s *Technology Review* and its subsequent coverage in the daily press. She shows how *The Times* article drew on the military expressions already present in the press release, which is further evidence of the influence that scientists have on the framing and presentation of their investigations (De Semir 2000a). Nerlich (2005a; 2008; 2012) has examined the metaphors associated with nanotechnology and notes that the *Fantastic Voyage* metaphors which framed earlier accounts on nanotechnology have been replaced by images of warfare and asks if the militarisation of such discourse is inevitable and desirable. As previously argued, the metaphor seems successful in explaining the inner structure of the nanoparticle. However, against the background presented in chapter 2, and given that the treatment was going to be tested on 25 patients participating in the trial, it is debatable whether such an image would appeal to patients or whether it would add further fear and anxiety (see also chapter 9).

Text (ti29) reports on two experiments that used nanotechnology to treat a form of skin cancer (melanoma) and lung cancer in mice. The ‘nanocell’, described as a ‘smart’ cell, combines two drugs to treat cancer cells and it overcomes two problems associated with conventional therapies: the *damage* caused in healthy cells and the *resistance* developed by cancer cells. Throughout the article there is extensive use of WVA metaphors (17 instances) to vividly convey the novel therapeutic approach. Most of the expressions are

conventional: the cancer drugs *attack* (6), *destroy* (2), *kill* (2), *target* (1) the cancer cells, while the tumour puts up *resistance* (1). However, when delving deeper into the explanation of how the treatment works and the inner structure and composition of the nanocell, more unconventional expressions appear. The drug uses a combination of two drugs to treat cancer cells:

(18) Its outer layer carries an “antioangiogenesis” agent that *attacks* the blood vessels with which tumours feed themselves. Beneath this it carries a chemotherapy drug that is toxic to cancer.

Professor Sasisekharan linked the plan of *attack* to “*dropping the bombs while cutting the supply lines*”. (ti29)

An innovation presented by this therapy is that the drugs are released from within the tumour, thus sparing healthy tissue. Then the two-stage process comes into play thanks to the double layer of the ‘nanocell’:

(19) Once it is inside the tumour cell, the outer membrane disintegrates, releasing the antiangiogenesis drug and causing blood vessels feeding the cancer to collapse. The nanocell’s inner “balloon”, full of chemotherapy drugs is then trapped inside the tumour, where it can release its lethal *payload* slowly without danger of *damaging* healthy tissue. (ti29)

Text (ti33) reports on another treatment that combines an antiangiogenesis drug (Avastin) with standard chemotherapy (paclitaxel) to treat breast cancer. The approach is explained by evoking a battlefield scenario:

(20) The study [...] shows that people survive almost twice as long if they take Avastin in combination with standard chemotherapy. The two drugs *fight* the cancer on different *fronts*. The chemotherapy treatment, paclitaxel, *attacks* the tumour while Avastin interferes with the formation of blood vessels that *starve* it of nutrients. (ti33)

Examples (17-20) have illustrated how expressions from the WVA source domain are exploited to explain the characteristics and the workings of new therapies. Although very often the metaphorical expressions are highly conventional, the rich semantics of war domain allows scientists and journalist to elaborate more creative images to account for the special properties of the new therapies. We shall now examine ways in which the WVA source domain is combined with other metaphorical systems to represent new therapeutic developments.

Text (ti13) shows a high number of metaphors from the WVA source domain (13), most of which are verbs used to describe the mutual actions between the nanocell and the

tumour: *destroy* (3), *kill* (2), *beating*, *target*, *eliminated*, *knocking out*. The new therapy, though, is conveyed predominantly through mechanistic metaphors and reference is made to the science fiction film *Fantastic Voyage*.

The new technology is described as ‘billions of tiny robots’ which are able to ‘track down’ and ‘kill’ cancer cells in the sub headline. In the lead, it is conveyed as ‘the world’s smallest biological computer’ which is ‘programmed’ to identify and kill cancer cells. DNA is said to be the ‘software’ of the miniature ‘machine’. It is acknowledged, though, that the possibility of developing ‘nanosubs’, a ‘smart drug’ or a ‘doctor in a cell’ is decades away.

Text (ti63) also displays an original combination of metaphors to present a therapy based on nanotechnology. As with the previous example, the article makes extensive use of WVA metaphors (17), many of which are verbs describing the actions of the drug: *destroy* (3), *target* (3), *attack* (2), *defend* (1), but the technology itself is conveyed as if it were a ‘nanobee’. This metaphorical expressions could be said to be a case of topic triggered metaphor (Koller 2003b), since the expression is motivated by the toxic compound used in the therapy, which is present in the venom of bees.

Two texts (gu50) (ti49) from the English subcorpus cover the experiments carried out by using light-activated antibodies to cure ovarian cancer in mice. Antibodies are proteins produced by the immune system in response to infection and disease.

The text from *The Guardian* made extensive use of metaphors from the WVA source domain to cover the story but it was combined with expressions from the semantic field of GARMENTS and MACHINES to explain the complexities of the action of the treatment:

(21) The new light therapy used “light-activated antibodies” to *kill* cancer cells. [...] under the new treatment, a patient would be injected with specially-designed antibodies that are *coated* in a light sensitive shell. The *coating* prevents the antibodies from causing a massive immune reaction throughout the patient’s body. Once the “*cloaked*” antibodies have been injected, doctors shine ultraviolet light on the patient’s tumour. This *activates* only those antibodies surrounding the cancer, which then attract the immune system’s *army* of *killer* T cells, to *destroy* the tumour. (gu50)

In a rather triumphant tone, the lead researcher, Professor Colin Self described the new therapy as the ‘equivalent of ultra-specific *magic bullets*’. The article also mentions that

Professor Self had recently set up a company called BioTransformations Ltd to develop the technology.

The Times article (ti49) picks up the metaphor from Professor Self and uses it in the heading of the article: “*Magic bullet*’ devised to *beat* cancer’.

(22) The *cloaked* antibody is linked to a second antibody directed against the tumour in a “double whammy”. When *uncloaked*, it *recruits* T-cells to *attack* the tumour at the same time as the antitumour antibody also *attacks* it. (ti49)

As we shall see in chapter 9, the innovations presented by some of these new therapies are conducive to representation and explanation by means of other metaphorical systems.

The remainder of this section examines examples from texts in which, in contrast to those discussed above, the use of expressions from the WVA source domain does not evoke clear militaristic scenarios, but other forms of killing or physical confrontation.

For instance, in two texts dealing with the role of stem cells in cancer, the metaphorical expressions evoke a PLANT scenario. This is arguably motivated by the metaphorical resonance of ‘stem’. Text (ti30) deals with the discovery of prostate cancer stem cells, which are the cells from which the rest of the prostate cancer cells originate (i.e. the *roots*). This discovery is said to be particularly relevant because although cancer treatments may eliminate ‘normal’ prostate cancer cells, they are not effective against prostate cancer stem cells, which are able to produce more cancerous tissue. By locating these prostate cancer stem cells, scientists may be able to develop treatments aimed at removing them. This is explained by drawing on metaphors used by one of the scientists:

(23) Professor Maitland explains that most cancer treatments try to *kill off* the bulk of cancer cells, leaving behind a stem cell population. But if you can *kill* the roots, “you *kill* the cancer for good”. (ti30)

Text (ti54) provides similar background information but this time the article deals with breast cancer stem cells. Again, the metaphor comes from a scientist but is slightly more elaborated to include not only the *root* but also the *stalk* and *blossom*:

(24) Dr Michael Lewis [...] said: “It’s not enough to *kill* the dandelion blossom and stalk. You have to *kill* the root as well. It appears that these cancer stem cells are *resistant* to the effects of anti-cancer drugs.” (ti54)

In some articles dealing with anti-angiogenesis treatment, the metaphorical expressions evoke physical conflict rather than the WAR scenario. In these texts the death of the cells is caused either by the restriction of blood which provides the nutrients to cancer cells – *starve* (see example 20 above) – or by the restriction of oxygen – *suffocate*, *throttle*, *choke*, and *strangle*:

(25) Cancerous tumours form a network of blood vessels to assist their growth. The drug, which has the trade name Avastin, blocks the formation and growth of blood vessels by targeting a protein in the cell. This stops the growth of the tumour, which finally “*suffocates*” to death. (gu30)

(26) Avastin and Erbitux interfere with angiogenesis, the formation of the new blood vessels that nourish the cancer and supply it with oxygen. Malignant tumours are highly vascular, as the cancers need a lavish blood supply to flourish. Inhibit the growth of the blood supply of a cancer and it is akin to both *throttling* and *choking* the tumour. (ti22)

(27) Another strategy is to attempt to *strangle* the tumours, using anti angiogenesis treatment. Cancers need to grow their own blood vessels as they get bigger, a process called angiogenesis. These new drugs halt the process, thus preventing the tumour from growing. (ti42)

In (25) and (26), given the specificity of the verb, the metaphorical nature of the expressions is signalled by the use of markers.

This section has served to give a taste of how a fairly broad range of the metaphorical expressions are realised in the English data by citing mostly single instances or brief examples that together cover a variety of the functions and patterns of the expressions in the discourse. To complete the discussion of the WVA metaphors in the English subcorpus, the next section examines the use of images from this source domain in an extensive sample text.

6.3.5 Analysis of a sample text from the corpus

This section provides a detailed analysis of the metaphorical expressions from the WVA source domain identified in text (gu40) from *The Guardian* subcorpus. This article was selected because it makes extensive and varied use of WVA metaphorical expressions, and the discussion focuses on how they interrelate and function in discourse, with special attention paid to the rhetorical structure of popularisation articles.

Sample Text 1. Common cold virus may be new weapon to fight cancer (gu40)

Common cold virus may be new *weapon* to *fight* cancer

- Human trials begin this year
- Scientists say move is ‘exciting’

5 British scientists are preparing to *launch* trials of a radical new way to *fight* cancer, which *kills* tumours by infecting them with viruses like the common cold.

If successful, virus therapy could eventually form a third pillar alongside radiotherapy and chemotherapy in the standard *arsenal* against cancer, while avoiding some of the debilitating side-effects.

10 Leonard Seymour, a professor of gene therapy at Oxford University, who has been working on the virus therapy with colleagues in London and the US, will lead the trials later this year. Cancer Research UK said yesterday that it was excited by the potential of Prof Seymour’s pioneering techniques.

15 One of the country’s leading geneticists, Prof Seymour has been working with viruses that *kill* cancer cells directly, while avoiding *harm* to healthy tissue. “In principle, you’ve got something which could be many times more effective than regular chemotherapy,” he said.

Cancer-killing viruses exploit the fact that cancer cells *suppress* the body’s local immune system. “If a cancer doesn’t do that, the immune system *wipes* it *out*. If you can get a virus into a tumour, viruses find them a very good place to be because there’s no immune system to stop them replicating. You can regard it as the cancer’s *Achilles’ heel*.”

20 Only a small amount of the virus needs to get to the cancer. “They replicate, you get a million copies in each cell and the cell *bursts* and they infect the tumour cells adjacent and repeat the process,” said Prof Seymour.

25 Preliminary research on mice shows that the viruses work well on tumours *resistant* to standard cancer drugs. “It’s an interesting possibility that they may have an advantage in *killing drug-resistant* tumours, which could be quite different to anything we’ve had before.”

Researchers have known for some time that viruses can *kill* tumour cells and some aspects of the work have already been published in scientific journals. American scientists have previously injected viruses directly into tumours but this technique will not work if the cancer is inaccessible or has spread throughout the body.

30 Prof Seymour’s innovative solution is to mask the virus from the body’s immune system, effectively allowing the viruses to do what chemotherapy drugs do – spread through the blood and reach tumours wherever they are. The big hurdle has always been to find a way to deliver viruses to tumours via the bloodstream without the body’s immune system *destroying* them on the way.

35 “What we’ve done is make chemical modifications to the virus to put a polymer coat around it – it’s a *stealth* virus when you inject it,” he said.

After the *stealth* virus infects the tumour, it replicates, but the copies do not have the chemical modifications. If they escape from the tumour, the copies will be quickly recognised and *mopped up* by the body’s immune system.

40 The therapy would be especially useful for secondary cancers, called metastases, which sometimes spread around the body after the first tumour appears. “There’s an awful statistic of patients in the west ... with malignant cancers; 75% of them go on to die from metastases,” said Prof Seymour.

The excerpt contains the first 537 words of a total of 741. With 21 metaphorical expressions from the WVA source domain, the text shows a metaphorical density of 28.3 per 1,000 words. The article reports on an experimental trial to be run in the UK involving the use of a genetically modified virus to treat cancer.

The article opens with a headline that already includes two metaphorical expressions from the WVA source domain, according to which the virus to be used in the trials may become a *weapon* to *fight* cancer. Thus, these metaphorical expressions activate the familiar scenario of WAR right at the beginning of the article and bring the scientific investigation closer to the reader to facilitate its understanding by presenting it within a predictable frame. Although medical treatments are often referred to as *weapons*, it could also be said that the metaphor arouses expectations – which it is especially true when the topic of the article is cancer, a disease with a great need for effective therapies – and it, thus, acts as a hook to catch the public’s attention. Therefore, it could be argued that the metaphor helps to strengthen the persuasive function that is characteristic of headlines. Nevertheless, a note of caution is introduced as the expectations aroused are toned down by the use of the modal ‘may’. Two subheadlines follow the headline with information about when the trials begin and an evaluation from the scientists, who label the *move* as ‘exciting’.

The first paragraph (lines 4-5) corresponds to the lead of the article and deals with three of the five-W-questions demanded by journalism: the actors (who) and place (where) are identified (British scientists) and the event (what) is presented (are preparing to *launch* trials of a radical new way to *fight* cancer). Some information on a fourth question (when) has already been supplied in the first subhead. Although the ‘how’ question is not typically included in newspaper articles as part of the lead, in scientific popularisation articles this question is of great importance when presenting and explaining scientific discoveries and developments (Mapelli 2006: 95). In this sample text, the way in which the scientists will treat cancer is also introduced in the lead (which *kills* tumours by infecting them with viruses like the common cold) and will be developed in the rest of the article. Thus, in the lead the WAR scenario is further exploited and elaborated by the use of the metaphorical expressions: *launch*, *fight* and *kill*.

Lines 6-8 evaluate the significance of the trial, thus supplying the initial answer to the final question of why the research is newsworthy. Again the journalist presents cancer treatment as ‘weaponry’; the viral therapy constitutes a potential addition to the already existing *arsenal* of radiotherapy and chemotherapy, but with improvements, since it entails fewer secondary effects.

Lines 9-12, which open the main body of the article, provide details about the leading scientist in the trial and a positive evaluation (‘excited’) in an indirect quote from the cancer charity supporting the investigation. This segment contains no WVA metaphorical expressions.

Lines 13-15 inform of the researcher’s own previous related work, in which viruses were used to *kill* cancer cells directly, thus avoiding the major disadvantages of standard treatments, which *harm* both cancerous and healthy tissue. This is reinforced by a direct quote from Professor Seymour, who claims that the therapy can be ‘many times more effective’ than conventional alternatives.

In lines 16-25, the journalist delves deeper into the explanation of how the virus works. Given that this explanation involves processes taking place at molecular level, a number of WVA metaphorical expressions are exploited to bring these processes closer to the reader. The virus, which had been introduced as a common cold virus, is now presented with a new role as a *cancer-killing* virus. The mutual actions of the cancer and the immune system are also explained by metaphorically used verbs from the WVA source domain: Cancers *suppress* the immune system in order to avoid being *wiped out* by it. It is this particular circumstance – the absence of the immune system inside the tumour – that is ‘exploited’ by the viruses because they can replicate freely. The scientist introduces the *Achilles’ heel* metaphor to explain how this situation can be regarded as the cancer’s weak point. Drawn from the Greek myth of Achilles, this image is conventionalised in language to express ‘a weak feature that someone or something has that could cause failure or could be attacked’ (*Macmillan Online Dictionary*). In this context, since the virus is portrayed as a *weapon* to *kill* the cancer, the metaphor has been included under the WVA source domain as the origin of the metaphor is imbued with military symbolism by evoking the Trojan War. In further direct quotes, Seymour first stresses the effectiveness of the virus, which causes the cancer cells to *burst*

through massive proliferation, repeating the process in other cells; and then points out the potential benefit of the ability of viruses to *kill* drug-resistant tumours. These comments on the promise held out by virus therapy close this first section of the main article.

Initiating a second cycle in the article, lines 26-29 pick up the thread of the argument through the most recurrent image of the ability of viruses to *kill* tumours; in contrast, non-metaphorical language is used to explain the difficulties of the direct technique for inaccessible tumours and widespread cancer.

Against this background, lines 30-39 highlight the novel solution provided by Professor Seymour's investigation. The virus is successfully delivered to the sites where it is needed by *masking* it so that it is not recognised and *destroyed* by the immune system. The journalist combines the WVA domain with expressions from the semantic field of GARMENTS. Moreover, the solution is said to overcome a *hurdle*, thus representing a major 'advance' in cancer understanding (see chapter 10). The explanation of why the viral therapy remains unaffected is then further developed when the journalist quotes the scientist. The virus has been modified by adding a polymer (a molecule) to the viral structure. Seymour also resorts to metaphors both from the GARMENT and WVA source domains. The *mask* has become a *coat* and this metaphor is reinforced by saying it is a *stealth* virus since it goes unnoticed by the immune system as it reaches the cells. The portrayal of the virus as a *stealthy* one could be motivated by the expression 'stealth bomber', which according to the *Macmillan Online Dictionary* is a 'military aircraft that cannot be noticed by radar'. Thus, in this context the virus corresponds to a military plane which dodges the body's surveillance system. The explanation of how the treatment works is then completed: once the virus has replicated in the cell, the new copies are *mopped up* by the immune system because they do not have the modifications that make them invisible.

Lines 40-43 round off this second cycle by commenting on the 'especially useful' application of the therapy to secondary cancers, which is supported by a direct quote from Seymour on the high mortality rate among patients with metastases.

The rest of the article continues with no further metaphorical expressions from the WVA source domain. It outlines how the trial will proceed, providing detail about the two viruses to be used, and closes with a quote from the director of the charity funding the research, who highlights the ‘exciting potential’ of the viral therapy under investigation, thus echoing the reactions mentioned in the second subhead and in the opening of the article. These final three paragraphs probably constitute the tail of the pyramid structure and could have been trimmed in editing if the necessary space had not been available.

The analysis of the metaphorical expressions from the WVA source domain in this article shows that they are widely exploited in order to perform a number of functions. One obvious function for all the war-related metaphors is to structure or to give cohesion to the whole piece, as indicated by the recurrent use of the conventional linguistic metaphors *fight* in the early part of the text and *kill* at various points throughout the article. In the headline, the portrayal of the virus therapy as a *weapon* most probably performs a persuasive function and serves to arouse expectations in readers inducing them to continue reading. In specific locations where the article delves deeper into the viral mechanisms, the metaphorical expressions serve to clarify the complex interactions between the virus, the cancer cells and the immune system. In this respect, it is significant that the journalist and the scientist both draw on congruent expressions from metaphorical systems other than the WVA source domain at specific points in the discourse to help to explain the special characteristics of the viral structure (GARMENT) and to account for the implications of the scientific achievement (MOVEMENT FORWARDS). However, it is also significant that it is the scientist who employs the most striking metaphors (*Achilles’ heel*, *stealth virus*) from the WVA source domain and those which dominate the discourse as a whole.

6.4 Analysis of the Spanish subcorpus

6.4.1 Quantitative analysis and metaphor selection

Table 6.4 summarises the metaphorical expressions from the WVA source domain identified in the Spanish subcorpus. As with the English analysis, the table contains the basic semantic concepts related to the metaphorical expressions found in the Spanish subcorpus three or more times and in at least two different texts. The complete list of metaphorical expressions can be found in Appendix B (table B.4).

Table 6.4 WAR, VIOLENCE AND AGGRESSION metaphors in the Spanish subcorpus

	<i>El País</i>	<i>El Mundo</i>	Total		<i>El País</i>	<i>El Mundo</i>	Total
Agresivo/a	31	44	75	Batalla	7	1	8
Atacar	36	25	61	Ganar	7	1	8
Supresor	37	24	61	Arma	4	3	7
Invadir	36	23	59	Arsenal	5	1	6
Resistencia	35	23	58	Erradicar	2	4	6
Bloquear	25	30	55	Primera línea	4	2	6
Defensa/s	21	33	54	Aliado/a	2	3	5
Destruir	27	13	40	Caballo de Troya	4	1	5
Estrategia	11	20	31	Guerra	5	0	5
Combatir	25	5	30	Bomba	1	3	4
Luchar	12	16	28	Vencer	2	2	4
Matar	15	9	24	Asesino/a/s	2	1	3
Dañar	11	5	16	Camuflarse	0	3	3
Eliminar	9	6	15	Disparar	3	0	3
Acabar	6	5	11	Enfrentarse	1	2	3
Talón	3	7	10	Objetivo	3	0	3
Enemigo	8	1	9	Reclutar	2	1	3

Of the ten most frequently used metaphorical expressions six are characteristic of scientific discourse in the field of oncology: *agresivo* ('aggressive'), *supresor* ('suppressor'), *invadir* ('invade'), *resistencia* ('resistance'), *bloquear* ('block') and *defensa* ('defence'), three refer to violent action: *atacar* ('to attack'), *destruir* ('to destroy'), and *combatir* ('to combat'). The single exception to these two patterns is the appearance of *estrategia* ('strategy') among the ten most frequent metaphorical expressions in the Spanish subcorpus. These expressions represent 68% (524 of 775) of the total number of WVA metaphorical expressions, a figure similar to that of the English subcorpus.

6.4.2 Intricacy of the WAR, VIOLENCE AND AGGRESSION source domain

In the Spanish subcorpus, the metaphorical expressions from the WVA source domain are also abundant and wide-ranging. Figure 6.3 displays the connections within this domain between the different linguistic metaphors centred around the concept of *guerra* ('war').

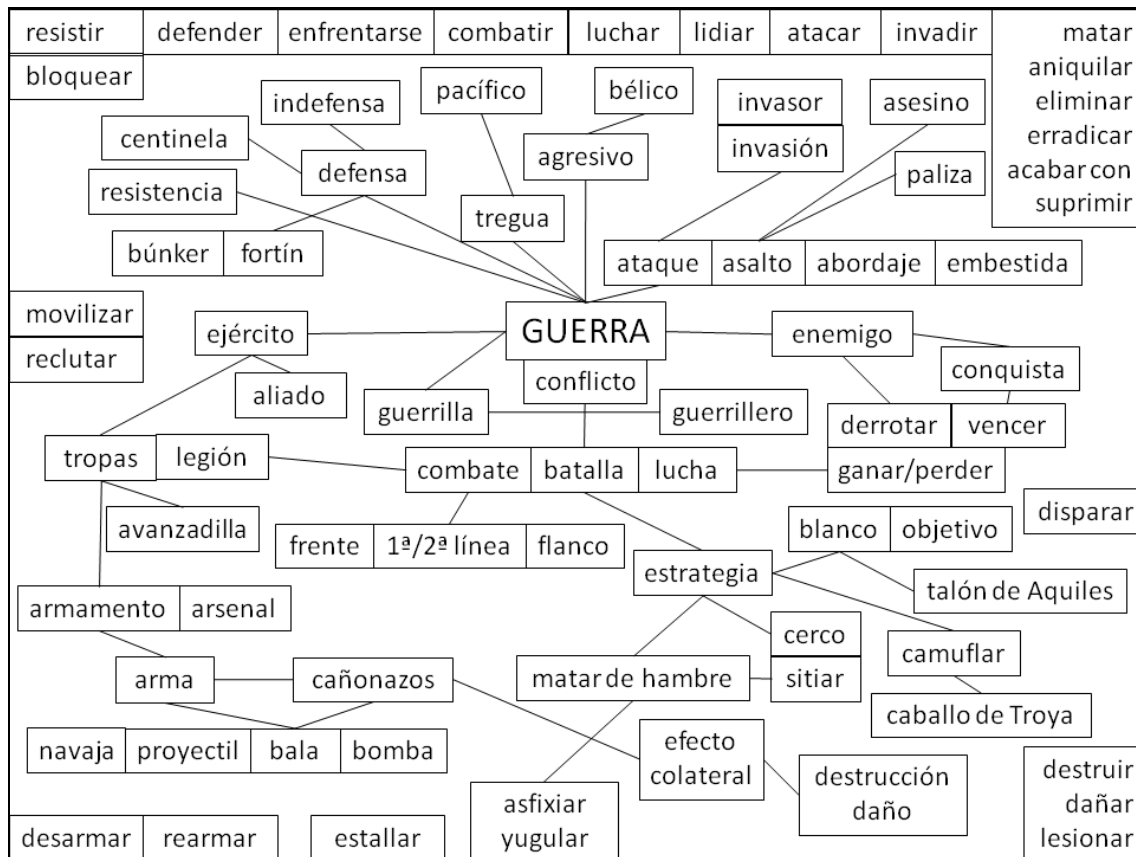


Figure 6.3 Relationships between metaphorical expressions in the WAR, VIOLENCE AND AGGRESSION source domain

In general, the Spanish articles present a scenario of confrontation between opposing forces. On one side of the *conflicto* (1) ('conflict') are the scientists and their treatments and the patients and their immune system; on the other, cancer, which through *invasión* (13) ('invasion') disrupts the *convivencia pacífica* (1) ('peace') in the body. Scientists seek ways to *movilizar* (1) ('mobilise') the *ejércitos* (1) ('armies') and the *tropas* (1) ('troops') of the immune system so that they *se enfrenten* (3) ('confront') and *se defiendan* (4) ('defend themselves') against the *asesino* (3) ('killer'). But the cancer

cells are also capable of finding *aliados* (5) ('allies') within the body to carry out their *asalto* (1) *agresivo* (66) ('aggressive assault').

Explicit mention of *guerra* ('war') is relatively unusual (5 instances) in the subcorpus of Spanish articles. However, the military scenario is evoked through other related expressions but at a lower level of generalisation: e.g., *batalla* (8) ('battle'), *combatir* (28) ('to combat'), *combate* (2) ('combat'), or *guerrilla* (2) ('guerrilla warfare').

Given the complexity of the conflict, the texts present a confrontation that is planned through *estrategias* (31) *bélicas* (1) ('strategies of war'). Thus, patients *se reclutan* (3) ('are recruited') to partipate in clinical trials, the results of which open up different *flancos* (2) ('flanks') in the *lucha* (14) ('fight/struggle') against the disease. Within the body, the aim is to tighten the *cerco* (1) ('siege') on, or *sitiar* (1) ('to besiege'), the disease-affected areas with different methods, such as introducing a *caballo de Troya* (5) ('Trojan horse') into the *fortín del enemigo* (1) ('enemy's fortress'). Alternatively, the aim is *desarmar* (1) ('to disarm') and *derrotar* (2) ('to defeat') cancer on different *frentes* (2) ('fronts').

Within this framework, therapies against cancer are presented via metaphorical expressions related to the semantic field of armament. Doctors have at their disposal a complex *arsenal* (6) ('arsenal') or *armamento* (1) ('armamentarium') consisting of different types of *armas* (7) ('weapons') and munition such as *bombas* ('bombs'), *proyectiles* (2) ('projectiles') and *balas* (2) ('bullets') that *se disparan* (2) ('are fired') to hit a *blanco* (2) ('target'), the cancer cells, so that these *estallen* (1) ('burst' or 'explode'). Nevertheless, the *ataque* (7) ('attack') to *ganar* (8) ('beat' or 'defeat') the *enemigo* (9) ('enemy') implies the *destrucción* ('destruction') of healthy cells. Thus the *conquista* (1) ('conquest') entails *efectos colaterales* (1) ('collateral effects').

The actions of the various agents involved in the confrontation are described through verbs of a violent nature: *atacar* (54) ('attack'), *destruir* (30) ('destroy'), and *matar* (24) ('kill'). Other less frequent verbs include *aniquilar* (2) ('annihilate') *yugular* (1) ('cut someone's throat') and *asfixiar* (1) ('suffocate'). There are also a number of verbs that express violent action euphemistically: *acabar con* (11) ('finish' or 'kill off') and *erradicar* (6) ('eradicate').

In response such violent actions, the different agents resort to *defensivas* (16) ('defensive') strategies. Certain genes act as *defensores* (1) ('defenders') and try to *bloquear* (45) ('block') the processes causing the cells to become malignant. In addition, the cells of the immune system act as a *defensa* (30) ('defence') against the *guerrilleros* (1) ('guerrilla fighters'). However, the cancer cells themselves also develop *resistencia* (29) ('resistance') and defend themselves against the action of drugs.

6.4.3 Degrees of metaphoricity

A notable absentee from the ten most frequently used WVA metaphors in the Spanish subcorpus (table 6.4) compared to the English top ten (table 6.2) is an equivalent for 'target'. The Spanish representations of the verbal, nominal and adjectival variants of target, which are highly represented in the English subcorpus, generally lack militaristic connotations. The Spanish counterpart of 'to target' is *dirigir* ('direct' or 'aim at') or *guiar* ('guide'). In English, the noun 'target' can be found in the collocations 'therapeutic target' and 'target cell'. In Spanish, the former is normally referred to as '*diana terapéutica*' and the latter as '*célula diana*', where '*diana*' is more strongly related to the semantic field of sports, specifically archery or hunting, the activity from which it evolved, but the term is also used in darts and is creatively exploited in one of the texts where the treatments are conceptualised as darts:

(28) La mala noticia es que cada tumor individual sigue su propio curso evolutivo, con mutaciones relevantes en unos 90 genes, de las que al menos 11 son cancerosas. La buena es que los farmacólogos tienen ahora 189 nuevas *dianas* contra las que dirigir sus "*dardos*". (ep40)²⁰

A closer equivalent to 'target' would be *blanco*, which also appears in the Spanish texts, albeit very rarely (2 instances in *El País*) or *objetivo* (2 instances in *El País*), as they both have militaristic connotations. In addition, 'target cell' is sometimes translated into Spanish as '*célula destino*' ('destination cell'), which would be related to the MOVEMENT and JOURNEY source domains.

²⁰ The bad news is that each individual tumour follows its own evolutionary course, with relevant mutations in about 90 genes, of which at least 11 are cancerous. The good news is that pharmacologists now have 189 new *targets* to *aim* their "*darts*" at.

As in the English subcorpus, technical metaphors also rank high in the Spanish subcorpus. In addition to the four expressions found in the English top ten – *agresivo* ('aggressive'), *supresor* ('suppressor'), *resistencia* ('resistance'), *bloquear* ('block') –, the Spanish subcorpus also includes *invadir* ('invade') (see chapter 7) and *defensa* ('defence'). All of these highly conventionalised linguistic metaphors are more frequent in the Spanish than in the English texts.

In contrast, the most recurrent representations of violent actions – *atacar* ('attack'), *destruir* ('destroy'), *combatir* ('fight') and *matar* ('kill') – show far higher frequencies in the English subcorpus. In the case of 'fight', this conceptualisation is also frequently (28 instances) represented by Spanish *luchar* ('fight' or 'struggle'). As seen in the English subcorpus, the concept of killing has multiple metaphorical manifestations not only through the basic 'kill' but also through its synonyms (*kill off*, *knock out*, *zap*) and euphemistic terms (*eliminate*, *eradicate*, *wipe out* and *mop up*). Similarly, the Spanish texts include not only *matar* but also variants such as *eliminar* ('eliminate'), *erradicar* ('eradicate'), *acabar con* ('kill off'), *aniquilar* ('annihilate'). Overall, the notion of 'killing' is represented 142 times in the English subcorpus compared to only 58 instances in the Spanish texts.

It should also be noted that the English subcorpus included approximately twice as many instances of *damage* compared to *dañar* both overall (89 and 45, respectively) and when used metaphorically (39 and 16, respectively).

Another difference between the subcorpora with regard to the ten most frequent metaphors is the presence of *estrategia* ('strategy') with 31 instances compared to only 14 in English. Whereas in the English texts *strategy* referred exclusively to techniques developed by scientists and applied experimentally or therapeutically to cancer, in the Spanish popularisations *estrategia* showed a higher degree of metaphoricity since tumours were occasionally said to use them against the immune system or to overcome other natural processes:

(29) El hallazgo permite saber mejor qué lleva a una célula a descontrolarse hasta resultar cancerosa. Pero el mayor problema es que cada tumor tiene su propia *estrategia* genética para saltarse esos controles. (ep40)²¹

However, such instances were not sufficient to account for the difference in frequency between the languages.

In tables 6.2 and 6.4, the ten most frequent metaphorical expressions in the English and Spanish subcorpora represented 68% of the total (645 of 946 in English and 524 of 775 in Spanish). The comparison of these metaphorical concepts and the analysis of their interrelations suggest that Spanish popularisations tend to rely more heavily on metaphorical expressions derived from scientific discourse; in contrast, popularisations in the English newspapers tend to represent the nature of the science-disease confrontation by greater exploitation of expressions of violent actions.

6.4.4 WAR, VIOLENCE AND AGGRESSION – Metaphorical patterns

Tables B.7 and B.8 in Appendix B detail the metaphorical expressions from the WVA source domain by text for each newspaper in the Spanish subsection of the corpus. Table 6.5 summarises the distribution of the Spanish texts in the high, intermediate and low frequency categories with regard to WVA metaphorical expressions. In the χ^2 analysis, no significant difference was found between the two newspapers with regard to this distribution ($P = 0.147$).

Table 6.5 Comparison of metaphor frequency distribution in the English subcorpus

Frequency	<i>El País</i>	<i>El Mundo</i>	Combined	Percentage
High (≥ 10)	12	8	20	13.3
Intermediate (4-9)	37	27	64	42.7
Low (1-3)	23	36	59	39.3
Zero	3	4	7	4.7
Total	75	75	150	100

χ^2 test: $\chi^2 = 5.370$; degrees of freedom = 3; $P = 0.147$

A total of 7 texts in the Spanish subcorpus contained no metaphorical expressions from the WVA source domain compared to 11 in the English subcorpus. A similar proportion of texts have low (1-3 metaphors) or an intermediate (4-9 metaphors) frequency: 39.3%

²¹ The finding allows a better understanding of what makes a cell go out of control and become cancerous. But the main problem is that each tumour has its own genetic *strategy* to evade those controls.

and 42.7%, respectively. In contrast only a small proportion of the articles contain 10 or more metaphorical expressions per text. When the Spanish and English subcorpora were compared (table 6.6), the Spanish subcorpus was found to have fewer texts in the high frequency category (20 vs. 31) and a far greater number in the low frequency group (59 vs. 36). Because of these differences, the χ^2 comparison showed a significantly different distribution between the two subcorpora ($P = 0.026$).

Table 6.6 English-Spanish comparison of metaphor frequency distribution

Frequency	English subcorpus	Spanish subcorpus
High (≥ 10)	31	20
Intermediate (4-9)	72	64
Low (1-3)	36	59
0	11	7
Total	150	150

χ^2 test: $\chi^2 = 9.300$; degrees of freedom = 3; $P = 0.026$

When the metaphorical expressions contained in the Spanish articles in the low frequency group (1-3 items) were analysed, most (98 of 121: 81.0%) were seen to come from the metaphors most frequently used (≥ 14 times) according to table 6.4. Thus, as observed with the English subcorpus, these texts only included isolated instances of the less frequent and, therefore, less conventional and more original images such as *aliado* ('ally'), *armamento* ('armamentarium'), *desarmar* ('disarm'), *efectos colaterales* ('collateral effects'), *palizas* ('beatings'), *reclutar* ('recruit') or *tregua* ('truce').

In what follows I will first consider two examples instantiating a WAR scenario and then discuss a group of texts which presented novel therapeutic solutions as a *Trojan horse* approach.

In the Spanish subcorpus, explicit mention of *guerra* ('war') is atypical, with only two texts including the metaphorical expression (see sample text 3). Nevertheless, the WAR scenario can be evoked by means of other related linguistic metaphors at a lower level of generality.

Text (ep61), for instance, made extensive use of WVA metaphors (14; although the density index is 14.9 per 1,000 words). This was particularly true in the lead of the article, where a cluster of metaphorical expressions from this source domain serve to

introduce the topic of the article in a vivid and attractive way by drawing on the *battle* scenario:

(30) En los sótanos del Hospital Clínico de Santiago se *libra* una *batalla* nuclear contra el cáncer. Un equipo de 17 médicos y físicos diseña cada día la *estrategia* para *acabar* con las células cancerígenas que *invaden* el cuerpo de los pacientes *disparando* electrones y protones. (ep61)²²

Example (30) depicts the doctors and physicists actively fighting against the disease, thus evoking the frame of WAR at a high level. It should be noted that the metaphorical scenario is triggered by the notion of ‘nuclear’, an aspect shared by the target (nuclear medicine) and the source (nuclear war). Nevertheless, it could be argued that for some readers the image may be too violent as the notion of ‘nuclear war’ is imbued with highly negative associations.

Sample text 2²³ illustrates the battle scenario but this time the conflict takes place at a lower level since the agents involved are different entities of the immune system and the tumour. The article reports on a case study published in the *New England Journal of Medicine (NEJM)* of a man who had recovered from advanced stage melanoma after treatment with cells (CD4 T lymphocytes) cloned from his own immune system. Text (em46) contains the highest number of instances (38) from the WVA source domain in the Spanish subcorpus, but because the article is particularly long (2,447 words), the density index is not especially high (15.5 per 1,000 words). However, over half of the instances (20) cluster in a subsection of the text labelled ‘Antecedentes’ (‘Previous research’), which discusses the significance of the case in the wider context of cancer research. This subsection contains 551 words so that the metaphor density here rises to 36.3. The extract reproduced in the box contains the first seven of the nine paragraphs that make up the subsection; the remaining two were excluded as they contained no further WVA metaphorical expressions and were mainly devoted to quotes from two Spanish experts in immunology, professors Ignacio Melero and Alfredo Prieto, who were consulted by the journalist for their assessment of the new findings. Interestingly, the quote from Prieto included in the extract contains only the conventional metaphorical expressions *defensas* (‘defenders’) and *ataque* (‘attack’); therefore, it

²² In the basement of Santiago Clinical Hospital a nuclear *battle* is being *waged* against cancer. Every day a team of 17 doctors and physicists design a *strategy* to *put an end* to the cancer cells that *invade* a patient’s body by *firing* electrons and protons at them.

²³ Complete English translations of the Spanish sample texts are provided in Appendix C.

appears unlikely that in this case the scientists' quotes resulted in the creative elaboration of the war scenario to recontextualise the new study for the public.

It should also be noted that in this article, which deals with the success of personalised treatment in a single case of a highly lethal form of cancer, the writer also draws on, and elaborates, other source domains. For instance, the representation of personalised medicine as 'tailored therapy' is combined with a war metaphor in the title: 'Autovacunas *de diseño* para matar al cáncer' ('Designer self-vaccines to kill cancer') (see chapter 9). In addition, successful treatment in the *NEJM* case is expressed in an unconventional instance from the MOVEMENT FORWARDS source domain as 'uno de los colofones de esta *andadura*' ('one of the highpoints along the path') (see chapter 10).

Sample Text 2. Autovacunas de diseño para matar al cancer (em 46)

Desde ese instante se comenzó a trabajar para que esta *estructura defensiva luchase* contra el cáncer a través de tres vías fundamentales: fortalecer los '*ejércitos*' propios para que *aniquilen* directamente a las células cancerosas, *bloquear* las señales bioquímicas que éstas emplean para multiplicarse, crecer y diseminarse, o anular los mecanismos y sustancias por los que el tumor acaba mermando el sistema inmunológico del paciente.

En un principio, los linfocitos CD8+ fueron los candidatos elegidos para formar la *primera línea de ataque* ya que estos glóbulos blancos son los verdaderos '*asesinos*' de las *tropas* del organismo. Sin embargo, se observó que éstos se agotan rápido y que, además, necesitan de la participación de los CD4, que son los que les suministran los factores de crecimiento para subsistir.

De hecho, un estudio publicado el pasado año en *Blood*, concluyó que dichos linfocitos constituyen una alternativa más eficaz que los CD8 para *acabar con* un tumor. El comentario adjunto, firmado por Melero, aconseja la inclusión de los CD4 en la elaboración de las vacunas antitumorales; y no sólo por su papel de proveedor de factores de crecimiento.

Y es que el tumor no es inerte. Hace todo lo posible por '*camuflarse*' y pasar desapercibido ante los *vigías* del sistema inmunitario para crecer con impunidad.

Sin embargo, «los CD4 también producen interferón gamma, una sustancia que obliga a las células cancerosas a presentar moléculas de histocompatibilidad en su superficie que lo hacen visible ante las *defensas*, algo que facilita el *ataque* de las mismas», argumenta Alfredo Prieto, profesor de inmunología de la Universidad de Alcalá de Henares, en Madrid.

Además, según el trabajo ahora publicado, los CD4 son capaces de ampliar la respuesta inmunológica. Es decir, en un primer momento se dirigen al antígeno NY-ESO-1, predominante en el tumor del paciente, pero luego desencadenan una reacción frente a otros dos (MAGE-3 y MART-1) también presentes.

En definitiva, los CD4 han resultado tener más funciones contra el *invasor* tumoral de lo que se creía en un primer momento y el caso recogido en el *NEJM* representa uno de los colofones de esta *andadura*.

Sin embargo, a pesar de los avances realizados en el conocimiento de las *estrategias 'bélicas'* que emplea el tumor para *ganar terreno* y el organismo para *erradicarlo*, desarrollar el *arma* definitiva que *acabe con* el cáncer no es sencillo.

The extract deals with previous research using an approach that focuses on boosting the response of the patient's immune system against the disease, with the former conceptualised as an *estructura defensiva* ('defensive structure') whereas the latter is personified as an *invasor* tumoral ('tumour invader). The approach involves three basic aspects or lines of development that are portrayed both within and outside the WAR frame: (1) strengthening the system's own "*ejércitos*" ('armies') to *aniquilar* ('annihilate') the cancer cells directly; (2) *bloquear* ('blocking') the biochemical signals used by these cells to multiply, grow and spread; and (3) neutralising the mechanisms and substances by which the tumour debilitates the immune system. In the first case particularly, it is the CD8+ T lymphocytes that are said to form the *primera línea de ataque* ('first line of attack') since they are the true "*asesinos*" ('killers') among the body's *tropas* ('troops'). However, CD4 T cells, whose main role is to supply growth factors to the highly personified CD8+ cells, are described in a straightforward manner except that they have been shown to be more effective than the latter in *acabar con* ('killing off') the tumour.

At the same time, the tumour is said to "*camuflarse*" ('camouflage itself') to pass unnoticed by the immune system's *vigías* ('lookouts'). This image, which is of nautical origin, was not considered as part of the WVA metaphor, but is clearly assimilated into the frame through contact with *camouflage*. It is at this point that the journalist brings in the expert's quote to explain a second role of CD4 cells: they produce interferon gamma, a substance that induces the cancer cells to present histocompatibility molecules (antigens) on their surface, and this makes them visible to the *defensas* ('defenders') and facilitates an *ataque* ('attack') by the CD4 cells. In the *NEJM* case, this involves a specific antigen (denominated NY-ESO-1), but the CD4 cells are able to broaden the response and induce a reaction against others (MAGE-3 and MART-4). Thus, the CD4 cells were shown to have more functions against the tumour *invasor* ('invader'), and cells that were generally considered *defenders* were able to go on to the *attack*.

Before proceeding to quote the experts, the journalist then rounds off this particularly lucid explanation of the implications underlying the reported case of melanoma. He states that, in spite of the advances in the understanding of the *estrategias "bélicas"* ('war strategies') employed by the tumour to *ganar terreno* ('gain ground') and by the

organism to *erradicar* ('eradicate') it, developing the ultimate *arma* ('weapon') to *acabar con* ('finish off ') cancer is not a simple matter. The caution in the warning at the end reflects the current limitations of personalised therapies for cancer. Of greater interest, however, is the skilful discursive exploitation of the metaphorical expression "war" strategies. This not only highlights the rare (at least in popularisations of cancer) military metaphor of *gaining ground*, but also stresses the military nature of *strategies* by placing scare quotes round the qualifying adjective "*bélicas*". In the discourse, "war strategies" acts as a kind of retrospective label casting the cancer-immune system confrontation in a new light and inviting the reader to reinterpret some of the non-metaphorical items as part of the WVA system.

Table 6.7 Summary of "war" strategies in excerpt from text (em46)

Immune System = Defensive structure	Cancer = Invader
Organism aims to <i>eradicate</i> tumour	Tumour aims to <i>gain ground</i>
<i>Defensive</i> structure <i>fight</i> s against cancer	Cancer <i>invades</i> organism
- strengthen <i>armies</i> to <i>annihilate</i> cancer cells	- emit signals to multiply, grow and spread
- <i>block</i> signals used by cancer cells	- use mechanisms + substances to debilitate immune system
- neutralise mechanisms + substances	
<i>Killers</i> (CD8) form the <i>front line of attack</i>	
Alternative <i>troops</i> (CD4) to <i>kill off</i> tumour	
CD4 produce IFN γ to make cancer cells visible	Tumour cells <i>camouflage themselves</i> to pass unnoticed by <i>lookouts</i>
<i>Defenders</i> (CD4) <i>attack</i> main antigen	
CD4 activate reaction against other antigens	
CD4 use multiple functions against <i>invader</i>	

Table 6.7 summarises the "war" strategies reflected in the extract and includes both those that contain an explicit member of the WAR scenario and those that are attracted into the system either by pairing with an opposing strategy or because they are implicitly carried out by one of the personified agents: *invaders*, *armies*, *troops*, *killers* and *defenders*.

The extensive, creative but far from exaggerated exploitation of the WVA source domain in the extract analysed contrasts with the conventional nature of the instances (n = 18) found in the rest of the article. Apart from the above-mentioned instance of *matar* ('kill') in the title, three synonyms are used (*acabar con*, *aniquilar* and *erradicar*), all of which also appear in the extract; it is of interest that only (em46) makes use of

‘annihilate’. ‘Attack’ occurs in four contexts, either as verb or noun, and three different ways of ‘blocking’ are referred to, the most interesting of which appears in a quote from the immunologist Melero, who points out the importance of cells that recognise more than one tumour antigen ‘para *bloquear* la mayor cantidad de vías de escape que emplea el tumor’ (‘in order to *block* the largest number of escape routes used by the tumour’) once it has become visible to the immune system. The two additional tokens of *estrategias* are those conventionally employed by scientists in approaches similar to that used in the *NEJM* case. However, the instance of *defensas* that appears in the lead, though identical in form to that in the extract, corresponds to the body’s *defences* rather than to the personalised *defenders*.

In a subdivision of the article describing the tumour types that are potential candidates for the kind of therapy used in the *NEJM* case, the writer introduces metaphorical expressions not included in the extract, but again they are highly conventional uses of *resistente* (‘resistant’) (2 tokens) and *agresiva* (once) (‘aggressive’). The single exception to this pattern is an occurrence of *frentes* (‘fronts’) in a context referring to a commitment to combined therapies ‘que *ataquen* los tumores desde diversos *frentes*’ (‘that could *attack* tumours from several *fronts*’). This metaphor only appears twice in the Spanish subcorpus, but this may be because it clashes with the compound preposition *frente a* (‘against’), which is frequently used in texts on immunology and cancer.

As seen in the English texts, the use of nanotechnology to treat cancer cells was expressed primarily through metaphorical expressions from the WVA source domain. In some examples, these expressions were combined with other images such as the *Fantastic Voyage*, which predominated in earlier accounts of this technology (Nerlich 2012), robots and machines and the topic triggered metaphor of the nanobee. In contrast, in three texts from the Spanish subcorpus, the journalists resorted to the image of the *Trojan horse* to make nanotechnology accessible to the lay audiences.

During the siege of Troy, the Greek army hid a number of their soldiers inside an enormous wooden horse and left it outside the city gates. Thinking the horse was a religious offering, the Trojans brought it into the city. Once inside, the soldiers emerged from their hiding place and opened the city gates to enable the rest of the Greek army to

enter and capture the city. In these texts, the way in which therapeutic agents are made to reach cancer cells is explained by evoking the well-known Greek myth.

The nanoparticles described in the articles consist of components whose function corresponds to three different stages: getting the lethal agent to the cancer cells but not to healthy tissue; getting it inside the tumour cells; and getting the agent to do its work.

The aptness of a metaphor depends to some extent on the correspondences that it establishes between the source and target. In (31), the *Trojan horse*, which appears in the lead (reproduced here in full) and is signalled as a metaphor, serves to set the readers' imagination in motion while they interpret the rest of the text:

(31) Un grupo de investigadores de Estados Unidos ha creado unas nanopartículas que, una vez inyectadas en un tumor maligno, pueden *matar* las células cancerígenas y dejar intactas las sanas. Por ahora el experimento sólo se ha realizado con ratones modificados genéticamente para expresar un tipo de cáncer, pero los resultados obtenidos han sido tan claros que sus autores confían en poder reproducirlos en humanos, dentro de dos años. De ser así, estas nanopartículas se convertirían en una especie de *caballo de Troya* que *destruirá* selectivamente células cancerígenas. (ep36)²⁴

The features of the nanoparticle are described in non-metaphorical language. This consists of a conventional anticancer drug (docetaxel) covered by DNA fragments called aptamers, molecules that recognise the cancer cells and bind the particle to their outer surface. Once inside the cells, the particles dissolve and release the toxic agent. Thus, in this text, the metaphor is presented in its simplest form and it is left to the readers' memory to establish the relevant correspondences, aided only by the associated *matar* ('kill') and *destruir* ('destroy').

In (ep25) and (em12), the nanoparticles are covered with folic acid or folate, two forms of a vitamin essential to cancer cells, the outer surface of which is replete with the corresponding receptors. The vitamin, therefore, performs the same function as the aptamers in the previous example. However, in these texts, the nature of the folate allows the writers to make explicit the mechanism of entry by combining the WVA domain with metaphorical expressions related to FOOD AND EATING:

²⁴ A group of American researchers has created some nanoparticles that, once injected into a malignant tumour, can *kill* the cancer cells and leave the healthy cells intact. At present the experiment has only been carried out on mice genetically modified to express a type of cancer, but the results obtained were so clear that the authors hope to be able to reproduce them in humans in two years' time. If so, these nanoparticles would become a kind of *Trojan horse* that would selectively *destroy* cancer cells.

(32) La nanopartícula es un ovillo de polímero con un diámetro de cinco nanómetros – de ahí su nombre – y con varios adaptadores: en uno se pega el metotrexato, un fármaco anticanceroso convencional, y en otro el ácido fólico (una vitamina). Las células cancerosas, que necesitan mucho ácido fólico para crecer, *dejan paso al caballo de Troya y se tragan inadvertidamente el fármaco que las matará.* (ep25)²⁵

In (32), the metaphor of ‘unwittingly *swallowing*’ the drug methotrexate together with the folic acid emphasises the fact that the cancer cells bring about their own downfall, as occurred in the siege of Troy.

In (em12), the main difference is that, instead of a conventional anticancer drug, the particles combine the vitamin folate with carbon nanotubes, which are selectively taken up by the cancer cells but activated from outside by shining a laser at them and raising the temperature beyond tolerable limits. In this text, the vitamin is said to be ‘avidly *consumed*’ by the tumour and, since it is the cancer cells that take in the nanotubes, the authors of the study, quoted indirectly by the writer, compare this to the introduction of a *Trojan horse* into the *enemy fortress*.

(33) Para ello se ha aprovechado que las células tumorales poseen una gran cantidad de receptores de folato en su superficie externa. Esta sustancia es un tipo de vitamina *consumida* con avidez por las neoplasias, una diferencia importante con respecto al resto de tejidos sanos del organismo.

Al recubrir los nanotubos de carbono con folato se consiguió que las propias células malignas lo incorporasen a su interior, algo que no ocurrió con las células sanas. Un sistema que los autores comparan con la introducción de un *caballo de Troya* en el *fortín del enemigo*.

La exposición al láser del líquido que contenía células malignas cargadas de nanotubos y células sanas que no los habían captado permitió ‘*matar*’ a las primeras rápidamente por calor. El resto, por el contrario, no se vieron afectadas. (em12)²⁶

In this case, the metaphor covers the fact that the final stage requires assistance from outside, with the laser corresponding to the returning Achaean troops after those inside the walls had opened the city gates. In both texts, however, the combination of

²⁵ The nanoparticle is a polymer ball five nanometres in diameter – hence its name – and with several adaptors: attached to one is methotrexate, a conventional anticancer drug and to another folic acid (a vitamin). The cancer cells, which require a large amount of folic acid for growth, *allow entry* to the *Trojan horse* and unwittingly *swallow* the drug that will *kill* them.

²⁶ This has been achieved by exploiting the fact that tumour cells possess a large number of folate receptors on their external surface. This substance is a type of vitamin avidly *consumed* by neoplasms, which is an important difference with regard to other healthy tissues in the body.

Covering the carbon nanotubes with folate induced the malignant cells themselves to take them inside, something that did not occur with the healthy cells and a system that the authors compared to introducing a *Trojan horse* into the *enemy’s fortress*.

Laser exposure of the liquid containing both nanotube-laden cancer cells and healthy cells that had not taken them up made it possible to quickly *kill* the former from overheating. The other cells, however, were not affected.

metaphors allows the journalists to account for all three stages of the nanotechnology explicitly.

In contrast to these three representations of nanotechnology, the writer of (em16) adopts a different approach. The study reported in this article is the same as that described in (31) above; however, instead of resorting to the image of the *Trojan horse*, the journalist mainly draws on the TRANSPORTATION source domain. This is first introduced in the lead, where the nanoparticles are described as ‘unos pequeños *vehículos* capaces de *llevar* y de liberar fármacos directamente en el interior de la célula cancerosa’ (‘small *vehicles* capable of *delivering* and releasing drugs directly inside cancer cells’):

(34) Científicos del Instituto Tecnológico de Massachusetts y la Universidad de Harvard (EEUU) diseñaron estos pequeños ‘*taxis*’, un millón de veces más pequeños de un metro, para *llevar* un fármaco (docetaxel) hasta las células malignas en tumores de próstata de roedores.

Para que las nanopartículas se adhiriesen únicamente a las células malignas, y no a las sanas, se emplearon pequeños fragmentos de ADN (aptameros) capaces de reconocer unas marcas específicas (los antígenos) presentes en la superficie de las células cancerosas.

Una vez adheridas a la superficie, las partículas fueron ‘interiorizadas’ por las células cancerosas de manera que liberaron su *carga* terapéutica justo en el interior.

Cuando ya está dentro, la nanopartícula, diseñada con materiales biodegradables, es capaz de liberar el agente terapéutico de un golpe, como si fuese una ‘*bomba*’, o bien prolongando su acción en el tiempo, durante meses e incluso años. (em16)²⁷

In (34) the *vehicles* are specified as small *taxis* that *carry* or *deliver* the drug to the cancer cells due to the properties of the aptamers. However, the transport metaphor only covers the first stage of the nanotechnology process; for the remaining stages, the writer uses the expression ‘interiorizadas’ (‘internalised’), where the scare quotes signal the unorthodox manner of the introduction of the *load* into the cells, and then switches to the WVA system to represent the sudden release mode of the drug’s action, which is

²⁷ Scientists at the Massachusetts Institute of Technology and Harvard University (USA) designed these little ‘*taxis*’, a million times smaller than a metre, to *deliver* a drug (docetaxel) to the malignant cells in prostate tumours in rodents.

In order to get the nanoparticles to bind only to the malignant cells and not the healthy cells, they used small fragments of DNA (aptamers) capable of recognising specific markers (antigens) present on the cancer cell surface.

Once bound to the surface, the particles were ‘internalised’ by the cancer cells so that they released their therapeutic *load* directly inside.

Once it is in, the nanoparticle, which is designed with biodegradable materials, is able to release the therapeutic agent all at once, as if it were a ‘*bomb*’, or prolong its action over a period of months or even years.

likened to a *bomb* exploding. Interestingly, this is the only war-related image in this article.

Therefore, in the explanation of the nanotechnology in this text, the journalist mainly relies on a non-militaristic description through expressions from the TRANSPORTATION source domain: *vehículo* ('vehicle'), *taxi* ('taxi'), *llevar* ('deliver'), *carga* ('load'). However, the need to resort to other representations to cover the last two stages of nanotherapy reveals the limitations of the mappings of the TRANSPORTATION system. This source domain is, therefore, not as congruent as evocation of the *Trojan horse* scenario, which, within the broader WVA framework and with the aid of specific FOOD AND EATING metaphorical expressions (examples 32 and 33), accounts for the complete therapeutic process.

6.4.5 Analysis of a sample text from the corpus

Sample text 3, reproduced below, represents the entire (ep66) text which has been drawn from *El País*. With 505 words, the article contains 16 metaphorical expressions from the WVA source domain, yielding a metaphor density of 31.7 per 1,000 words, the highest in the Spanish subcorpus. (Ep66) reports on the presentation of a genetic *map* of two tumours charted by American scientists. The numerous mutations identified in the genes implies a radical change in the approach to cancer.

The headline introduces a cluster of metaphorical expressions from the WVA source domain that help to define and frame the topic of the article. Based on a quote from one of the scientists, the headline reads: The *fight* against cancer, a *guerrilla war*. Although the 'war against cancer' is frequently used to talk about the disease, qualifying it as a *guerrilla war* breaks with convention and thus obliges the reader to view the target from a different angle. In the case of deliberate metaphor, the shift of perspective is, according to Steen and co-workers (2010), the main communicative purpose; nonetheless, the metaphor can also fulfil other communicative functions at the same time (Steen *et al.* 2010: 59). In this headline, I would say that the function of the *guerrilla* metaphor is predominantly persuasive and aims to arouse the readers' curiosity.

Sample text 3. La lucha contra el cáncer, una guerra de guerrillas (ep66)

La *lucha* contra el cáncer, una *guerra* de *guerrillas*

El descubrimiento del mapa genético completo de dos de los tumores más letales y su vinculación con múltiples mutaciones modifica las bases de la *lucha* contra la enfermedad

5 El descubrimiento completo del mapa genético de dos de los tipos de cáncer más letales, uno cerebral y otro pancreático, realizado por los científicos del Centro Oncológico Kimmel de la Universidad Johns Hopkins de Estados Unidos ha revelado las razones que explican las dificultades que existen a la hora de encontrar una cura una vez se ha extendido el tumor y que, según sus conclusiones, se esconden bajo la mutación de numerosos genes sin un patrón establecido.

10 El nuevo mapa, elaborado a partir del estudio tumoral más completo que se haya realizado hasta la fecha, según destaca el propio centro, y en el que se han evaluado mutaciones en los más de 20.000 genes de 24 cánceres pancreáticos y 22 cerebrales, demuestra en opinión de sus autores que la mayoría de los casos están provocados por alteraciones en los procesos regulatorios que incluyen numerosas variables.

15 Según publica hoy la revista *Science*, este descubrimiento cambia el concepto acerca de los tumores sólidos y su control, así como de los fármacos u otros agentes que *atacan* los efectos fisiológicos de esos procesos. Bert Vogelstein, co director del Centro Ludwig de Johns Hopkins e investigador del Centro Médico Howard Hughes, ha destacado a la publicación que esos fármacos, más que las particularidades individuales de los componentes genéticos, probablemente constituyen un enfoque más útil para desarrollar nuevas terapias contra la enfermedad.

20 En la misma línea, su compañero de estudio, Kenneth Kinzler, profesor de oncología y codirector del centro, ha agregado a raíz de las conclusiones del mismo que “el panorama de los cánceres humanos es claramente mucho más complejo que lo que se creía hasta ahora”. “*Combatirlo* va a ser una *guerra* de *guerrillas* más que un *conflicto convencional* porque hay decenas de genes mutados en cada uno de los tumores”, ha asegurado.

30 En el cáncer pancreático, las alteraciones incluyeron el sistema de control de daños en el ADN, la maduración celular e *invasión* tumoral correspondientes a entre un 67 y un 100% de los tumores. Además de los procesos, en ambos estudios se identificaron genes mutados, incluyendo 83 oncogenes en el cáncer pancreático y 42 en la forma más letal de cáncer al cerebro, el glioblastoma multiforme.

También, se determinó una considerable sobreexposición de 70 genes en proteínas cancerígenas que están en la superficie de la célula o que son secretadas lo que los convierte en un *blanco* para un potencial diagnóstico.

35 Según Kinzler, considerar esas mutaciones de forma individual no parecerían ser un gran obstáculo. “Sin embargo, cuando operan de manera conjunta, se convierten en un *enemigo* que nos exigirá desarrollar nuevas *estrategias* para *combatirlos*”, explica. Por este motivo, para el científico la mejor *estrategia* a largo plazo “será la detección temprana de los tumores, cuando el número de *guerrilleros* es todavía pequeño y todavía se les puede controlar”.

The subheadline (lines 2-3) clarifies the bold statement of the headline in mainly straightforward language, but again the scientific effort is placed within the metaphorical scenario of WAR:

The discovery of the complete genetic map of two of the most lethal tumours and their connection with multiple mutations modifies the basis of the *fight* against the disease.

The linguistic metaphors from the WVA source domain are then largely absent from the body of the article until reappearing in a quote from one of the scientists, who draws on this metaphorical scenario to explain the new approach that needs to be adopted to deal with the disease.

The lead (lines 4-9) briefly answers three of the five W-questions:

What? – The discovery of the complete genetic map of two of the most lethal types of cancer – a brain tumour and a pancreatic tumour – [...] has revealed the reasons that explain the existing difficulties in the search for a cure once the tumour has spread and which, according to their conclusions, lie hidden beneath the mutation of numerous genes with no established pattern;

Who and where? – carried out by the scientists of the Kimmel Cancer Center at Johns Hopkins University in the United States.

Lines 10-14 provide further information on the study including details regarding the number of genes and tumours investigated, and the finding that in most cases the alterations in the regulatory processes are multifactorial.

Lines 15-21 deal with the immediate impact of the discovery, which will change the understanding of solid tumours and their management, as well as the drugs and other agents employed to treat them. This paragraph contains only one metaphorical expression *atacan* ('attack'), which describes the action of these substances on the physiological effects of the processes involved, and is consistent with the frame established in the headline. Bert Vogelstein, one of the co-authors, is then quoted indirectly to provide an evaluation of the outcome of the research: it is these drugs that *attack* the processes, rather than individual gene components, that are likely to prove a more useful approach for developing new therapies.

In lines 22-26, a second co-author, Kenneth Kinzler, is then quoted directly as he explains the longer-term implications of the results in the approach to cancer. He predicts that, since the panorama of cancer is much more complex than was previously believed:

Fighting it is going to be more of a *guerrilla war* than a *conventional conflict* because there are dozens of mutated genes in each tumour.

Kinzler, therefore, draws on the established 'war on cancer' metaphor to clarify the significance of the study for the public by elaborating the image and describing the

approach in terms of the *guerrilla* scenario. The metaphorical expression, which is also used in the headline with an attention-grabbing function is utilised here with a more pedagogical role against the background previously presented.

In lines 27-34, the journalist provides details concerning the number of mutated genes identified for each of the two cancers studied and the alterations involved in certain cellular processes: DNA damage control, cell maturation and tumour *invasion*. Although the first two terms are also metaphorical, of particular interest for this analysis of the WVA source domain is the linguistic metaphor of tumour *invasion*: this war-related expression is commonly employed to refer to the process of metastasis (see chapter 7). In addition, 70 genes that secrete proteins or make them accessible on the cell surface are said to be a *target* for diagnosis. The fact that the journalist employs *blanco* for target in this context is of especial interest, since the usual Spanish translation is *diana* in both technical and popularised medical texts. The Spanish subcorpus contained 79 instances of *diana* in 47 texts (49 in 26 *El País* texts and 30 in 21 *El Mundo* texts) compared to only 2 tokens of *blanco*. Whereas *diana* is more related to the semantic field of sports, *blanco* has militaristic associations. The journalist may, therefore, have chosen the latter to fit the war scenario exploited in the text.

The journalist concludes the article by again quoting Kinzler to explain the significance of the multitude of mutations identified in the study. The conclusion contains additional elaboration of the WVA source domain. Individually the mutations would not represent too much of an obstacle, but ‘working together, they form an *enemy* that will require us to develop novel *strategies* to *combat* them’; for this reason, according to the scientist, the best long-term *strategy* ‘will be early detection of tumours, when the number of *guerrilla warriors* is still small and they can still be controlled’.

Thus, the scenario, first introduced in the headline and then reintroduced through the researcher, is further explained by equating the mutated genes with the *guerrilla warriors*.

The analysis of the metaphorical expressions of the WVA source domain in this text shows that they are not uniformly distributed in the article, clustering at three points in the text (initial, medial and final location). This pattern is consistent with Koller’s

(2003b) study of WVA metaphors in marketing magazine texts. This bracketing by metaphor clusters not only frames the topic in question but also summarises the text. In addition, these war metaphor clusters may be motivated by other rhetorical purposes including a persuasive function.

It is also noteworthy that half (8 of 16 instances) of the metaphorical expressions appear in direct quotes from one of the scientists informing about the research. The metaphors appearing in quotes from scientists are an interesting area to explore since scientists are aware that metaphor is useful not only to explicate abstract and complex issues to the public, but also to justify their investigations and attract funding (Petsko 2001). Therefore, such statements made by scientists are socially relevant, as pointed out by Petersen (2005): “Through news releases, staged news events, and choice of particular language in quotations offered to journalists, scientists may help set the agenda for discussion of science and technology issues and their implications” (Petersen 2005: 205).

The aim of the analyses of texts (gu40) and (ep66) was to elucidate how metaphorical expressions from the WVA source domain interrelate and function in cancer popularisation articles. Text (gu40) illustrates how the linguistic expressions from this source domain serve to provide texture and coherence to the text both through recurrent use of expressions such as ‘*fight* cancer’ or ‘*kill* the tumour cells’ and through less conventional and more striking images, as in the case of the ‘*stealth* virus’. The analysis also sought to emphasise the importance of taking the genre under study into consideration. Since the different constituent parts of a popularisation article have particular rhetorical goals, metaphors – together with other linguistic strategies – can help to achieve the desired effect. This is clearly illustrated in text (ep66), where the repetition of closely related metaphorical expressions in the headline and in the closing statements of a subsection and the complete article performs two different dominant functions. In the headline, the image helps to draw the readers’ attention to the text whereas in the quotes from the scientist towards the end of a subsection or article, the metaphor serves an explanatory purpose or encapsulates the significance of the investigation.

6.5 Summary

This chapter has dealt with the metaphorical expressions from the WVA source domain in the corpus of cancer popularisation articles.

The quantitative analysis has shown that the number of WVA metaphors is higher in the English subsection of the corpus (946 vs. 775 instances) and, when the two subcorpora were compared taking text length into account, a significantly higher metaphor density was found in the English articles (12.14 vs. 7.50 per 1,000 words). These differences can be explained, at least in part, by the lack of militaristic connotations of the Spanish counterparts of the lemma *target*, which is conspicuous (160 tokens) in cancer popularisation articles given its current status as a crucial concept in oncology.

Both subcorpora were found to exhibit an extremely varied range of metaphorical expressions from the WVA source domain. It has also been pointed out that, although some expressions appear only loosely connected with the notions of war and violence (i.e. polysemous words or euphemistic expressions), they can generally be interpreted as realisations of the WVA source domain as they frequently occur in the vicinity of more prototypical WVA expressions and are thus 'attracted' into the metaphorical system or scenario.

Comparison of the ten most recurrent WVA metaphorical concepts revealed a tendency in the Spanish subcorpus towards the use of consolidated metaphorical expressions from scientific discourse whereas the English subcorpus relied more on images related to violent action.

When the actual realisations of WVA metaphorical expressions were examined in the texts, the analysis showed that this system is not always extensively exploited in the articles. In both the English and Spanish subcorpora, the WVA metaphors were found to be unevenly distributed, and in 31.3% and 44% of the articles, respectively, they appeared only sporadically (1-3 instances) or not at all. When the focus was placed on those articles that make a particularly original and systematic use of WVA expressions, these linguistic metaphors were shown to perform a range of important discourse

functions either as a single frame of reference or in combination with other metaphorical systems.

Although the use of metaphors imbued with militaristic and violent connotations has been strongly criticised, this chapter has paid attention to how they serve to bring cancer-related knowledge closer to the lay audiences by elucidating complex aspects of the disease, especially cancer treatments, in an amenable and familiar way. The more controversial aspects will be dealt with in chapter 9, which concerns the use of WVA source domain expressions in the portrayal of conventional treatment as opposed to novel therapies which may be still under development.

Chapter 7

Metastasis and its metaphors

7.1 Introduction

This chapter deals with the metaphorical expressions used to describe the process of metastasis. Section (7.2) broadly introduces the topic of metastasis and accounts for the conceptual metaphors attributed to this process in scientific domains. I then move on to present the results of the analysis. In terms of the use of metaphor in the recontextualisation of metastasis, there are notable differences between the two subcorpora. The results for each of the languages under study are presented in two separate sections. Section (7.3) is concerned with the analysis of the English subcorpus and includes text excerpts to illustrate how the different source domains are realised in the data, together with a detailed analysis of a sample text. Section (7.4) includes the analysis of the linguistic metaphors identified in the Spanish subcorpus for the explanation of metastasis. Given that the metaphorical expressions in the Spanish subcorpus are more numerous, examples are provided to account for the clustering, patterning and roles of the metaphors in the discourse. As with the English section, a detailed sample analysis is included. The chapter is rounded off in section (7.5) with an overview and summary of the main findings presented in the empirical sections.

7.2 Metastasis and its metaphors in scientific genres

The term ‘metastasis’ (μετάσταση) is of Greek origin meaning ‘transference’, ‘removal’ ‘change’. The noun derives from the verb *methistanai*, a compound consisting of the prefix *meta* (‘over’, ‘across’) and the verb *histanai* (‘set’ or ‘place’). The process can be very broadly defined as the spread of cancer. It is the growth of a secondary tumour in an organ different from the one first affected (Streuli 2006: 359).

Metastasis is highly complex and is yet to be fully understood. However, it is of crucial importance given that metastatic cancers are the cause of 90% of the deaths from this disease (Hanahan and Weinberg 2000). The following excerpt serves as a working definition of the process for this thesis. The quotation is also illustrative of the wide array of metaphorical expressions that can be found in scientific genres when discussing this process.

Sooner or later during the development of most types of human cancer, primary tumour masses *spawn pioneer* cells that move out, *invade* adjacent tissues, and thence *travel* to distant *sites* where they may succeed in *founding new colonies* [...]. The capability for *invasion* and metastasis enables cancer cells to *escape* the primary tumour mass and *colonize* new *terrain* in the body where, at least initially, nutrients and space are not limiting (Hanahan and Weinberg 2000: 65, my emphasis).

Metaphors used for the description of metastasis in specialised scientific genres have been described by van Rijn-van Tongeren in her book *Metaphors in Medical Texts* (1997). The author mentions two main conceptual metaphors, TUMOUR CELLS INVADE AND COLONISE and TUMOUR METASTASES ARE SEEDS SOWN FROM THE PRIMARY TUMOUR, each of which she relates to two medical theories for this process.

Van Rijn-van Tongeren (1997: 83) relates the conceptual metaphor TUMOUR CELLS INVADE AND COLONISE to Halsted’s theory of metastasis (1907).²⁸ According to this theory, metastasis takes place progressively, with cancer cells first spreading to the lymph nodes and then moving on to secondary organs. The excerpt reproduced below is an abstraction of the metaphorical expressions which Van Rijn-van Tongeren subsumed under the conceptual metaphor TUMOUR CELLS INVADE AND COLONISE:

²⁸ Apparently, Halsted was developing the anatomical model for metastasis which had been first proposed in 1874 by the British surgeon Campbell Greig De Morgan (Comen 2012).

Metastatic tumour cells have to *escape* from the primary tumour and *enter* the blood and/or lymphatic circulation. To be able to *complete* their *course* they must have many properties. They have to *survive* in the circulation, *evading* or *withstanding adverse conditions*, while the rules of *survival of the fittest* apply. Their *fate* varies. Their “*chance of survival* largely coincides with their *chances of escape* from the circulation”. En route, the tumour cells have to *invade* tissues and blood vessels, *penetrate* membranes, *gain access* to lymphatics and blood vessels, *migrate* and *immigrate*, *traverse boundaries* and *transgress borders*. “With increasing size of cancer elements in *transit*, *traffic* is governed more and more by the rules of embolization”. Finally, the tumour cells may initiate a *colony* in a specific secondary organ. Their *success*, however, depends in their *homing* potential (van Rijn-van Tongeren 1997: 71, emphasis as in original).

In an appendix, as realisations of this conceptual metaphor, she also includes other expressions: *invasion front*, *metastatic colonisation potential*, *colonize*, *cross*, *host territory* (van Rijn-van Tongeren 1997: 151-156).

Semino and co-workers (2004), in their analysis of metaphors in a corpus of conversations about cancer, mention the difficulty in delimiting the boundary between the literal and metaphorical in the context of metastasis. The truth is that cancer cells do, quite literally, move within the body from one place to another. In van Rijn-van Tongeren’s examples there are a number of words that she analysed as metaphorical, but which from my point of view should be taken as non-metaphorical. Thus, I do not consider the following expressions as metaphorical: ‘enter’, ‘penetrate’ and ‘gain access’. In addition, although I agree with the metaphorical nature of *escape*, *migrate* and *immigrate*, I would not subsume these expressions under the source domain of INVASION AND COLONISATION. The expression *escape* carries the connotation of getting away from an unpleasant situation and a degree of volition may also be involved. In addition, the expressions *migrate* and *immigrate* would be better classified under what I have called the MIGRATION source domain. Although van Rijn-van Tongeren does not mention this source domain in her book, these metaphorical expressions can also be considered to be technical since ‘cell migration’ is an area of research addressed by a number of subdisciplines in the natural sciences (Chicurel 2002).²⁹

The conceptual metaphor TUMOUR METASTASES ARE SEEDS SOWN FROM THE PRIMARY TUMOUR described by van Rijn-van Tongeren is based on Stephen Paget’s ‘seed and

²⁹ It should be noted, however, that the INVASION AND COLONISATION and MIGRATION source domains are not completely unrelated since the establishment of a colony involves the migration of the colonisers to the new settlement, but whereas colonisation is out of greed, immigration is out of need.

soil' hypothesis for metastasis. His theory was spelt out in an article published in *The Lancet* in 1889. Paget sought to explain why particular cancers metastasised in some organs but not others. For instance, breast cancer cells tend to metastasise to the lungs and brain. Thus, he was concerned with: "What is it that decides what organs shall suffer in a case of disseminated cancer?" (Paget 1889: 571). He formulated his model as follows:

Every single cell must be regarded as an organism, alive and capable of development. When a plant goes to seed, its seeds are carried in all directions; but they can only live and grow if they fall on congenial soil (Paget 1889: 571).

The author provided statistical evidence which suggested that the bones were particularly affected with metastasis in breast cancer patients. Thus, at the end of the article he concluded that metastasis showed a "dependence of the seed upon the soil" (Paget 1889: 573).

The theory could be paraphrased as follows: cancer cells (*seeds*) are *disseminated* throughout the body and the secondary organ (*soil*) provides suitable *environmental* characteristics for the cancer (*plant*) to grow. With this theory, Paget sought to emphasise that for metastases to develop, not only were the *seeds* important, but also the *soil*. Paget's proposal remains a hypothesis to date; nevertheless, his model is still driving research into metastasis and remains productive since the metaphorical formulation of his hypothesis allows scientists to make inferences about aspects of the source domain and investigate how they may be mapped onto the target domain (see for instance Comen 2012, Scott *et al.* 2012).

Van Rijn-van Tongeren (1997) included the following examples from the specialised literature in her study to illustrate the TUMOUR METASTASES ARE SEEDS SOWN FROM THE PRIMARY TUMOUR conceptual metaphor:

Primary tumours from which lung metastases are *seeded*
Tumour-cell *dissemination*
At the end of the *dissemination* phase, the potential *seeds* of such metastases range from a single tumor cell to a tumor embolus visible with the naked eye.
The size of these *seeds* [of metastases]
Interactions between "*seed* and *soil*" (Van Rijn-van Tongeren 1997: 179).

It is pertinent to review the metaphorical systems employed in the scientific literature because these are also exploited in popularisation articles, either in similar ways or through creative elaboration. In this context, Knudsen's (2003) notion of the 'closing' and 'opening up' of technical metaphors is particularly useful. When these metaphors are first introduced in scientific contexts, they are signalled as alien in the discourse and the correspondences between the source and target domains need to be made explicit. After a given metaphorical model is tested and validated, its metaphoricity fades away and it may establish itself as a specific concept within a scientific field (i.e. the metaphor is 'closed'). In genetics discourse, for instance, CODE metaphors such as *translation*, *messenger RNA* and *code* have acquired specialised senses as the knowledge in this field has increased (Knudsen 2003: 1254).

In non-specialised contexts, however, closed metaphors may need to be 're-opened' (i.e. marked as metaphorical and/or elaborated) for the benefit of the lay audiences who may not have sufficient knowledge for the adequate interpretation of the terms or the topic under discussion (Knudsen 2003: 1254-1255).

This section has provided a working definition for metastasis and a review of the metaphorical expressions that have been identified for the spread of cancer cells in specialised genres. It has also been pertinent to introduce Knudsen's notions of the 'closing' and 'opening up' of technical metaphors since, as will be shown, these processes come into play in the recontextualisation of metastasis in the press.

7.3 Metastasis in the English subcorpus

7.3.1 Quantitative analysis of metaphors of metastasis

The process of metastasis is mentioned or dealt with in the English press in 62 texts (22 from *The Guardian* and 40 from *The Times*) of the 150 texts which constitute the English subcorpus. However, the technical term 'metastasis' or other derived forms ('metastasise', 'metastases', 'metastatic') are not too recurrent. In *The Guardian*, the term and derivations appear only 10 times, and in 5 texts, and in *The Times* they occur 15 times and in 7 texts. Instead, the process is referred to as the 'spread' (*The Guardian*

21 texts, *The Times* 36 texts) or ‘movement’ (*The Guardian* 5 texts, *The Times* 8 texts) of cancer cells, or metastases are said to be ‘secondary cancers’ (*The Guardian* 3 texts, *The Times* 5 texts).

Table 7.1 Metaphorical expressions for metastasis in the English subcorpus

Source domain	Metaphorical expressions	<i>The Guardian</i>		<i>The Times</i>		Combined	
		No. texts	No. instances	No. texts	No. instances	Total texts	Total instances
INVASION	<i>invade</i>	0	0	4	5	4	5
AND	<i>invasive</i>	0	0	2	2	2	2
COLONISATION	<i>foreign invader</i>	1	1	1	1	2	2
	<i>colonise</i>	0	0	2	2	2	2
	<i>colony</i>	0	0	1	1	1	1
MIGRATION	<i>migrate</i>	0	0	3	3	3	3
	<i>migration</i>	1	1	1	1	2	2
JOURNEY	<i>travel</i>	0	0	1	1	1	1
Others	<i>crawling</i>	1	1	0	0	1	1
	<i>marauder</i>	0	0	1	1	1	1
	<i>rampage</i>	0	0	1	1	1	1
	<i>rogue</i>	0	0	1	1	1	1
Total			3		19		22

Table 7.1 shows the metaphorical expressions for metastasis identified in the English subcorpus. The metaphor count for this process in the English press is rather low, especially in *The Guardian*, where metaphorical expressions for metastasis were only identified in two texts (gu53) and (gu73). In *The Times* there is a greater variation but, as will be shown below, compared with the Spanish press, the number of metaphorical expressions is still scarce. Despite the small number, two source domains employed to popularise the process of metastasis have been identified – INVASION AND COLONISATION and MIGRATION. In addition, a few texts included scattered metaphorical expressions involving personification and ‘intertextual’ metaphors.

7.3.2 INVASION AND COLONISATION source domain

The INVASION AND COLONISATION source domain is realised in the data by the following metaphorical expressions: *invade*, *invasive*, *foreign invader*, *colonise* and *colony*. As mentioned in the previous section, these linguistic metaphors are also found in scientific genres.

The adjective *invasive* was found in two texts and in both instances the metaphorical expression appeared in a direct quote from a scientist. In these cases the term *invasive* denotes that the tumour or the cancer cells have the potential to metastasise:

(1) “The other 20 per cent have a more *invasive* tumour that also requires hormone treatment and chemotherapy. The problem is that we don’t know who has which.” (ti09)

(2) Dr Goding said: “These *invasive* cancer cells develop in response to conditions inside the tumour. Once they have spread to other areas of the body, their new *environment* determines whether they remain *dormant* or whether they start dividing again to form new tumours.” (ti41)

In (1) *invasive* appeared together with metaphorical *colonise* (see example 8), non-metaphorical ‘spread’ and the technical term ‘metastasize’. In text (2), *invasive* was the only metaphorically used word for metastasis while ‘spread’ and ‘move’ were employed non-metaphorically to refer to the process. The combination of the expressions *environment* and *dormant* may be evoking the notion of ‘dormant seeds’ that are unable to germinate due to unfavourable conditions for growth. However, in the absence of a more explicit reference to plants, the presence of these two expressions alone is not enough to trigger a PLANT scenario. Thus, in these examples it could be argued that the metaphors used to talk about metastasis are ‘partially opened’ through the use of non-metaphorical language.

The verb form *invade* occurred 5 times in the corpus and was present in 4 texts. Only once (ti35) was the expression identified in a quote from a scientist. The expression could appear in combination with other more creative images, as in (3), where the journalist explains the four different stages of colorectal cancer and the corresponding expectation of survival:

(3) If the cancer has *breached* the bowel *wall*, but there is no spread to the lymphatic glands, 80 per cent of patients will have no further trouble. If the cancer cells have *invaded* the nearby lymph nodes (glands), 60 per cent of patients will survive. If the cells have reached the more distant lymphatic glands, 30 per cent will have a good outlook. If the cancer has *travelled* to a more distant site, less than 5 per cent have an encouraging prognosis. (ti22)

Each of the 4 different stages mentioned, is defined in terms of expressions related to movement, most of which are metaphorical. In this way, the initial stage is described as the escaping from a bounded space (*breached* the bowel *wall*), the second stage is portrayed as the illegitimate occupation of an area (*invaded*), the third stage is expressed

non-metaphorically through the expression ‘reached’. In the final stage, the cancer is said to have *travelled*, the only metaphorical expression from the JOURNEY source domain in the English subcorpus. Through the use of this last expression, which is more generic and less violent than the notion of *invasion*, the bleak prognosis is somehow toned down or at least it is not further dramatised. In contrast to examples (1) and (2), where the use of metaphorical expressions was limited, in this fragment the different stages of metastasis are described in a more vivid way through the combination of expressions representing different types of movement.

Although the instances in which cells are said to *invade* other organs have been subsumed under the INVASION AND COLONISATION source domain, it should be noted that the notion of *invasion* may also involve the personification of cancer cells. This personification is more evident when cancer cells are portrayed as deviant characters who are ‘up to no good’ in the body:

(4) WHAT MAKES a cancer spread? What turns a treatable tumour into a *marauder*, *rampaging* through the body to *invade* other organs? Neuroscientists at Imperial College London think that they have the answer – and it is causing a stir among oncologists. (ti27)

(5) Cancers are all caused by genetic mutations that promote unchecked cell division, and they kill when this *rogue* tissue *invades* vital organs. (ti53)

Although these 3 metaphorical expressions (*marauder*, *rampaging* and *rogue*) were the only instances found in the English subcorpus, it could be argued that they depict cancer cells (tumours and cancerous tissue) as ‘outlaws’ who disrupt the social order within the body by breaking biological laws.³⁰ In (4) the metaphorical cluster is located in the lead of the article: thus, it could be argued that the combination of these metaphorical expressions within the rhetorical question is a strategy to introduce to the reader the topic of the article in an amenable and engaging way.

Cancer cells are also personified through the expression *foreign invaders*. In the contexts where these expressions appear, there is a minimal elaboration of the metaphorical theme through the presence of other metaphorical expressions from the WAR, VIOLENCE AND AGGRESSION source domain:

³⁰ According to Edwards (2003: 104-106) the conception of cancer cells as displaying deviant behaviour is stressed by contemporary theories of cancer.

(6) Helper T-cells are specialised white blood cells that identify *foreign invaders*, or cancerous cells, and *marshal* other elements of the immune system against them. (ti55)

(7) If the cells did *cross* the placental *barrier*, the child's immune system should have recognised them as *foreign invaders* and *destroyed* them. (gu73)

In both examples the expression appears in the context of the immune system, and the journalist through metaphorical expressions from the WAR, VIOLENCE AND AGGRESSION source domain describes the action carried out by the immune system in violent terms.

Metaphorical expressions related to the notion of *colonisation* are also scarce with only 2 metaphorical expressions of *colonise* and one instance of *colony*, which is singled out by means of scare quotes. All three instances were found in *The Times*:

(8) One of the biggest challenges facing a cancer physician is knowing whether the tumour is going to spread (metastasize). Most cancer deaths are caused not by the original cancer but by the effects when it *colonises* other parts of the body. Whether the cancer spreads had been thought to be largely a matter of chance, so most cancers are treated equally aggressively, just in case. (ti09)

(9) Using a new kind of imaging system, scientists will for the first time be able to watch how cancer cells grow, move, enter and leave blood vessels and *colonise* distant sites. (ti50)

(10) Writing in the American journal *Cancer Research*, they say that although only 0.1 per cent of the cells they took from prostate tumours were cancer stem cells, this small number had been able to direct other, lesser cells to develop into "*colonies*" of tumours four times their own number. (ti30)

In (8) and (9) only non-metaphorical expressions related to movement were found in the immediate co-text (spread, move, enter and leave).

The INVASION AND COLONISATION source domain, with 12 metaphorical expressions, is the most recurrent metaphorical system used to deal with the process of metastasis in the English subcorpus taken as a whole. Surprisingly, only one realisation (*foreign invader*) of this source domain was found in *The Guardian* newspaper, although this metaphorical theme would have been familiar in view of the long history of colonialism. However, journalists working at *The Guardian*, whose editorial line is left oriented and thus tends to be more critical with the subject of the British Empire, might consider this metaphor as inappropriate since it may be offensive to the newspaper's increasingly multicultural English readership.³¹ This claim, however, needs to be verified by further

³¹ Crystal and Russ (2010: 34) in their humorous book *Sorry, I'm British* argue that "the word 'colony', even prefixed by the word 'former', is only ever heard in a historical context". Of course, no references to back up this claim were provided given the sarcastic tone and format of the book, which provides a

analysis of a larger corpus. The expressions from the INVASION AND COLONISATION source domain in *The Times*, which also involve some degree of personification, are sometimes combined with other metaphorically used words which portray cancer cells and tissue as engaged in illegal activities, as shown in examples (4) and (5).

7.3.3 MIGRATION source domain

The source domain of MIGRATION was realised by the fairly conventional metaphorical expressions cell *migration* (1 instance in *The Guardian* and 1 in *The Times*) and the verb form *migrate* (3 instances in *The Times*).

(11) Way said: “Our findings represent a new way to regulate a key family of proteins involved in cell *crawling* that will change the way researchers see current models of cell *migration* – an important aspect of the spread of cancer.” (gu53)

(12) Scientists [...] have found that a gene involved in making cells stick together is less active in aggressive breast tumours than in those that develop more slowly. The gene, called ALCAM (activated leucocyte cell adhesion molecule) is linked with cell *migration*. The more free the cells are to move, the quicker the potential spread of the cancer. (ti16)

In addition to the metaphorical expression of cell *migration*, the quotation in (11) from *The Guardian* contains the more technical expression of cell *crawling*, which describes a specific way in which cells move around the body. It should be noted that the topic of the whole article is metastasis, and the fact that no other metaphorical expressions to explain the process of metastasis are present – apart from these two in the quote of a scientist – is somewhat striking.

(13) The team, led by Joan Massague, took cancer cells from a patient with an aggressive and metastatic breast tumour and transplanted them into mice. They then selected the cells that *migrated* to the animals’ lungs, and screened them for genetic changes. (ti28)

(14) Twenty tumours, for example, changed from oestrogen receptor (ER) negative to ER positive when they *migrated* to the lymph nodes. This means that hormone therapies such as tamoxifen, which would not have worked for the original tumour, could help treat the disease if it spread in its ER positive form. (ti70)

In contrast to other metaphorical expressions, which may be seen as more alien in the context of cancer and hence may require the use of ostensive signalling and definitions, the notion of *migration* is conventional and largely self-explanatory, as shown in

glossary of notions and facts that are genuinely British. However, their remark points to a general tendency towards the omission of the topic of colonialism.

examples (11) - (14). Although in its basic sense migration is attributed to people or animals, in everyday speech it can be found in other contexts such as computing. It is for this reason that the term requires no scare quotes and minimal explanation. The next section, however, includes a detailed analysis of a sample text in which the metaphorical notion of cells migrating is highly elaborated and ‘opened up’ to frame and explain a scientific discovery which sheds light on the process of metastasis by describing how cells move towards distant organs.

7.3.4 Sample text from the English subcorpus

In (ti08) the journalist reports on a scientific discovery in the field of metastasis in an original way by drawing on the popular fairy tale *The Pied Piper of Hamelin*. The story, like many popular tales, has many variations, but the article is based on the one where a piper enchants the rats of Hamelin with the tune coming from his magic flute and leads them away from the city. This story is culturally grounded and, in Zinken’s terminology, is an example of an ‘intertextual metaphor’ which alludes to a culturally salient text (Zinken 2003: 509).

Sample text 4. ‘Pied Piper’ clue to cancer spread (ti08)

‘*Pied Piper*’ clue to cancer spread

THE spread of cancer around the body is guided by a protein that acts like the *Pied Piper* attracting the *rats of Hamelin*, scientists have found.

The discovery could make it possible to halt the spread by *silencing signals* sent by the protein. That would make cancer treatment much simpler. At present, once the illness has spread to several organs it is usually impossible to stop.

Researchers at the Breakthrough Breast Cancer Toby Robins Research Centre in London found that breast cancer cells follow a protein called uPA that *helps* them to *migrate* around the body.

When the action of this protein was *blocked* with antibodies, the cells stopped moving. It is hoped that the discovery will lead to ways of halting the spread of breast cancer.

The research, reported today in the *Journal of Cell Biology*, showed that breast cancer cells producing a protein called Endo180 were attracted to uPA. If either protein was missing the cells no longer moved.

The scientists tried blocking the action of uPA using antibodies that *latched* on to Endo180 - the equivalent of *blocking out the piper’s tune by fitting the rats with ear plugs*. They found that this stopped the cells being drawn to the uPA protein.

Clare Isacke, who led the study, said: “We now know that Endo180 antibodies have the potential to stop the spread of certain breast cancer cells.”

The article's headline introduces the metaphorical scenario to be developed in the rest of the text: "Pied Piper' clue to cancer spread'. The lead summarises the research by elaborating the metaphorical association presented in the headline. Parallels are established between the uPA protein and the Pied Piper, on the one hand, and breast cancer cells and the rats of Hamelin, on the other.

The second paragraph explains that the progression of cancer could be halted by *silencing* the *signals* emitted by the protein. The *silencing* metaphorical expression is often used in scientific literature with reference to genes. Essentially, genes produce proteins and a technical metaphor often used to convey this is that of genes *expressing* a protein; if they cease to do this because the chemical reaction is blocked, they are *silenced*. However, in this context a trait characteristic of genes is applied to their product; thus, it might be argued that there is some kind of metonymic relation taking place. This may be because the protein, or Pied Piper, is the relevant participant and in order to maintain the coherence with the scenario introduced in the headline and lead, the signal (the Pied Piper's tune) needs to be silenced in order to stop the movement of the cells.

The metaphorical scenario is further developed near the end of the article where the journalist explains how the scientists managed to stop the action of this protein. Essentially, the movement of cancer cells took place by the interaction between uPA and another protein produced at the cells' surface, Endo180. This interaction was inhibited with the use of antibodies which *latched* on to Endo180. In order to elucidate this process in an amenable way, the journalist draws on the Pied Piper's story and creatively modifies the plot. In the explanation, Endo180 is the equivalent of the rats' (breast cancer cells) *ears*, and the antibodies are likened to *plugs* which are *fitted* into them. As a result, breast cancer cells no longer 'hear' the *signals* emitted in the Pied Piper's tune.

Table 7.2 provides a summary of the correlations that are established between the biological entities and the scientific notions on the one hand, and the adapted fairy tale on the other.

Table 7.2 Source to target domain correspondences for *Pied Piper* intertextual metaphor

	Target domain	Source Domain
Biological entities	uPA molecule	Pied Piper
	breast cancer cells	rats
	Endo180 (protein)	rats' ears
	antibodies	earplugs
Actions	to spread	to migrate
	silencing (block chemical reaction)	silencing (block Piper's tune)
	latch	fitting (earplugs)

Thus, in this text, the popular fairy tale of *The Pied Piper from Hamelin* is creatively exploited and adapted to account for the scientific discovery in an amenable and accessible way to the readers.

7.3.5 Summary of the English subsection

Overall, metastasis is dealt with in the English press with little metaphorical aid. This is especially true of *The Guardian*, where only three metaphorical expressions were identified for this process, two of which came from a quote from a scientist. In *The Times*, there is a greater reliance on metaphorical language, mainly drawing on the source domains of INVASION AND COLONISATION and MIGRATION, which may be combined and partly elaborated with other metaphorical expressions, as in 3 texts which characterise the metastatic cancer cells as outlaws who disrupt the bodily social order by infringing biological laws. Finally, text (ti08) has been commented on as the only example of creative exploitation of metaphorical language to elucidate the process of metastasis. In this article, the journalist skilfully adapts the story of *The Pied Piper of Hamelin* as a frame of reference to understand the scientific discovery.

7.4 Metastasis in the Spanish subcorpus

7.4.1 Quantitative analysis of metaphors of metastasis

Metastasis is mentioned or dealt with in 70 texts (36 from *El País* and 34 from *El Mundo*) out of a total of the 150 texts which constitute the Spanish subcorpus. The specialised term ‘metástasis’ (metastasis) and its variants are highly conspicuous in the Spanish press (table 7.3). In contrast to the English subcorpus, the technical term or a derived form appears in nearly all of the texts dealing with this process (30 texts from *El País* and 29 texts from *El Mundo*)

Table 7.3 Frequency of metastasis and related forms in the Spanish subcorpus

	<i>El País</i>		<i>El Mundo</i>		Combined	
	No. texts	No. instances	No. texts	No. instances	Total texts	Total instances
Metástasis	29	107	27	104	56	211
Metastásico/a	5	6	13	15	18	21
Metastatizar	1	1	2	2	3	3
Micrometástasis	1	1	1	9	2	10

Nevertheless, other alternative non-metaphorical expressions also abound in the Spanish texts: e.g. ‘expansión’ (‘expansion’), ‘extender’, ‘extensión’, ‘extendido’ (all ‘spread’), ‘propagarse’ (‘propagate’) ‘progresión’ (‘progression’), ‘desplazarse’ (‘move’).

The topic of metastasis is not only more central to the content of the Spanish articles but also has a wider number of associated metaphorical systems. The most predominant of these in the subcorpus are the INVASION AND COLONISATION and DISSEMINATION source domains. These two metaphorical systems can be tracked down to scientific discourse and to medical theories for metastasis (see van Rijn-van Tongeren 1997). Another two source domains exploited in the Spanish subcorpus are MIGRATION and JOURNEY. Of these, the former can be traced back to scientific texts (van Rijn-van Tongeren 1997, Chicurel 2002). In contrast, the JOURNEY source domain seems to be more characteristic of popular accounts of metastasis. In addition, cancer cells are portrayed as volitional agents and are sometimes criminalised since they are said to be involved in delinquent activities. Table 7.4 provides a summary of the relevant metaphorical expressions included under each of the four source domains.

Table 7.4 Metaphorical expressions for metastasis in the Spanish subcorpus

Source domain	Metaphorical expressions	<i>El País</i>		<i>El Mundo</i>		Combined	
		No. texts	No. instances	No. texts	No. instances	Total texts	Total instances
INVASION AND COLONISATION	<i>colonizar</i>	4	5	1	2	5	7
	<i>colonias</i>	2	3	0	0	2	3
	<i>colonización</i>	0	0	1	1	1	1
	<i>invadir</i>	9	17	5	8	14	25
	<i>invasión</i>	7	9	4	4	11	13
	<i>invasivo</i>	3	4	4	5	7	9
DISSEMINATION	<i>diseminación</i>	6	14	3	3	9	17
	<i>diseminar(se)</i>	3	4	3	3	6	7
	<i>implantación</i>	0	0	1	1	1	1
JOURNEY	<i>viajar</i>	4	6	6	6	10	12
	<i>viaje</i>	3	4	3	4	6	8
	<i>destino</i>	1	1	1	1	2	2
MIGRATION	<i>migrar</i>	1	1	2	2	3	3
	<i>migración</i>	0	0	2	2	2	2
	<i>emigrar</i>	2	2	1	1	3	3
	<i>anidar</i>	3	4	2	3	5	7
	<i>nidificación</i>	1	1	0	0	1	1
Total			75		46		121

In the following, I provide a general description of the metaphorical expressions which have been subsumed under the four source domains listed in the table. Since the more conventional metaphorical expressions will be seen in text excerpts discussed in the ensuing sections, here I only include examples of less recurrent metaphorically used words for each of the source domains under consideration.

INVASION AND COLONISATION. This is the most recurrent metaphorical system in the Spanish subcorpus, especially in *El País*. It is most often employed by the journalists, since it only appears in scientists' quotes in 2 instances in *El País* and in 3 in *El Mundo*. As in the English subcorpus, the only instance explicitly signalled as a metaphor by means of scare quotes is *colonia* ('colony'), which appears twice in a text from *El País*.

(15) Nuevas '*colonias*'

[...] Esta estimulación hace a las células madre producir una sustancia, las citoquinas CCL5, que a su vez ayudan a las células del cáncer de mama a moverse por los vasos sanguíneos y encontrar nuevos lugares donde establecer '*colonias*'. (ep53)³²

³² New '*colonies*'

[...] This stimulation makes stem cells produce a substance, the CCL5 cytokines, which in turn help breast cancer stem cells to move through the blood vessels and to find new sites to establish '*colonies*'.

It should be noted that other metaphorical expressions from the source domain of WAR, VIOLENCE AND AGGRESSION could also be related to this source domain. However, for the sake of simplicity I have only included here the metaphorical expressions directly related to the notions of *invasion* and *colonisation* (see chapter 6). Similarly, many of the negative statements levelled at the WAR, VIOLENCE AND AGGRESSION source domain can be associated with the INVASION AND COLONISATION source domain since a colonisation generally involves a violent and aggressive invasion. However, in contrast to the other metaphorical systems presented below, the source domain of INVASION AND COLONISATION includes the notion of an illegitimate appropriation of a territory, which in a sense is more consistent with the malignant growth of cancer cells in different parts of the body.

DISSEMINATION. The metaphorical expressions in this group are all fairly conventional, with *diseminación* ('dissemination') and *diseminar* ('disseminate') being the most predominant. These expressions are, therefore, not singled out by means of scare quotes in the Spanish subcorpus. However, one isolated example related to this source domain – *implantación* ('implantation') – stands out in the corpus as it is less conventional:

(16) “Estos genes no sólo permiten el crecimiento del tumor primario”, explica Nadal a elmundo.es, “sino que facilitan la *implantación* de las células malignas en el pulmón”. (em29)³³

In example (16), a direct quotation from a scientist, genes are said to facilitate the *implantación* ('implantation') of malignant cells in the lungs. In this case, the underlying metaphor is not so much that of cells as *seeds* but rather of cancer as a *plant* from which you extract a scion and transplant it in another environment (organ) for it to grow there. In other contexts, isolated instances which depict cancer as a plant have also been identified:

(17) Si se ataca a las demás células del tumor, pero no a sus células madre, “el cáncer seguirá ahí”, dice Dick. “Es como una mala hierba en el jardín; puedes cortar las hojas, pero si quedan las raíces siempre volverán a crecer de nuevo. Tenemos que cortar las hojas y las raíces”. (ep55)³⁴

³³ “These genes not only allow the growth of the primary tumour”, explains Nadal to elmundo.es, “but also facilitate the *implantation* of the malignant cells in the lung”.

³⁴ If the other cells of the tumour are attacked, but not its stem cells, “the cancer will still be there”, says Dick. “It’s like a weed in the garden, you may cut off the leaves but if the roots are left they will always grow again. We need to cut off the leaves and the roots”.

The framing of cancer as a plant in (17) may be motivated by the fact that in English *células madre* are called *stem* cells (stem cells are also sometimes referred to as *células troncales*, which would be a direct translation of the English term). What is interesting is that the PLANT theme can be extended and applied to describe both metastasis and cancer treatment. In contrast to the INVASION AND COLONISATION source domain, the DISSEMINATION source domain could be claimed to be more patient friendly as less violent imagery is implied. In addition, as shown by example (17), the general conceptualisation of cancer as a PLANT could be further exploited since it allows for more correspondences to be established between the source and the target domain.

MIGRATION. Another metaphorical system exploited in the Spanish press in the context of metastasis is that of cells migrating. In contrast to the English subcorpus, greater variation has been identified within the expressions subsumed under this source domain. Metaphors have been identified to conceptualise the process in general *migración* ('migration'), the movement of cancer cells *migrar* ('to migrate') and *emigrar* ('to emigrate'), and the process of settling in a new organ *anidar* ('nest') and *nidificación* ('nidification' or 'nest-building').

(18) Massagué reconoce «la dificultad de aislar células de metástasis en el cerebro». Para solventar este obstáculo, su equipo inyectó en varios ratones células metastásicas de origen humano. El estudio de esas células, que ‘emigraron’ a distintas regiones del organismo de los roedores, reveló diferencias genéticas significativas entre ellas. (em62)³⁵

It should be noted that in (18) the metaphorical expression *emigraron* ('emigrated') reinforces a metaphorical reading of *regiones* ('regions') which is a conventional and 'closed' technical metaphor to refer to different parts of the body in the discourse of anatomy.

The metaphorical expression of *anidar* ('nest') appeared 7 times in the corpus and it was signaled once as metaphorical. The abstract and possibly more technical variant *nidificación* ('nidification') was present in a quotation from a scientist:

³⁵ Massagué recognises “the difficulty in isolating metastatic cells in the brain”. To overcome this obstacle, his team injected several mice with metastatic cells of human origin. The study of these cells, which ‘emigrated’ to different regions in the rodents’ organism, revealed significant genetic differences between them.

(19) Las metástasis son la principal causa de muerte en los pacientes con cáncer. Se trata de un proceso que comienza cuando las células tumorales abandonan su localización primaria para desplazarse hasta otros órganos en los que son capaces de ‘anidar’. (em40)³⁶

These last two expressions were not present in the English press, but in the Spanish subcorpus they suggest the conceptualisation of cancer cells as migrating birds. These expressions could, therefore, be seen as equivalent to *colonise* and *implantation*, since they refer the way in which cancer cells become established in a secondary organ. As with expressions from the DISSEMINATION metaphorical system, the source domain of MIGRATION has the advantage of not being violent. However, outside the context of metastasis, this theme does not seem to be transferable to cancer in general.

JOURNEY. The metaphorical expressions of *viaje* (‘journey’) and *viajar* (‘travel’) can be subsumed under the JOURNEY source domain. They appeared 8 and 12 times, respectively, in a total of 15 texts out of the 150 which constitute Spanish subcorpus. These metaphorical expressions did not appear in quotes from scientists, suggesting that journalists resort to this image in accounting for metastasis. In addition, they tended to be found in the lead (8 of 15 texts), and often in combination with other metaphorical expressions from the INVASION AND COLONISATION, and DISSEMINATION source domains, as will be shown in the following section.

In four texts from *El Mundo* the expressions *viaje* and *viajar* were highlighted from the rest of the text by means of scare quotes:

(20) Son ya varias las compañías farmacéuticas que están investigando posibles compuestos capaces de bloquear TGFb para interrumpir este ‘viaje’. (em42)³⁷

(21) Massagué y su equipo lograron entonces identificar un grupo de 18 genes fundamentales para comprender el mecanismo por el que las células malignas ‘viajan’ desde el tumor primario, en la mama, hasta los pulmones. (em29)³⁸

In the Spanish data, metaphorical expressions from these four source domains are extensively used and combined in the articles. Although there is a general ethos that

³⁶ Metastases are the main cause of death in cancer patients. Metastasis consists of a process which begins when tumour cells leave their primary location and move towards other organs where they are able to ‘nest’.

³⁷ There are several pharmaceutical companies investigating possible compounds capable of blocking TGFb in order to interrupt this ‘journey’.

³⁸ Massagué and his team succeeded in identifying a group of 18 genes which are fundamental for understanding the mechanism by which malignant cells ‘travel’ from the primary tumour, in the breast, to the lungs.

metaphors should not be mixed, it has been shown how in actual texts metaphorical expressions from different source domains are combined without placing excessive processing pressure on the reader or disrupting the coherence of the text (Kimmel 2010). In addition, although the four source domains under discussion involve different scenarios, they all share an underlying PATH schema and, thus, could be said to be consistent at a cognitive level.

In order to do justice to the various patterns in which these expressions manifest themselves and to the functions they perform in the texts, the remainder of this chapter provides examples illustrating this usage in accounting for and discussing the process of metastasis.

7.4.2 Metaphorical clusters in the reporting of metastasis

In contrast to their relatively sparse presence in the English subcorpus, metaphorically used words to recontextualise metastasis abound in the Spanish subsection. Although in the previous section these metaphorical expressions have been presented separately for the sake of clarity, in the data they manifest themselves in combination. Take the following example which is the opening of an article in *El País*:

(22) La *lucha* contra la metástasis, la *diseminación* del cáncer a otros órganos diferentes del originalmente afectado, se ha convertido en el *frente* de investigación oncológica más activo. Los intrincados *mecanismos* celulares se *interrogan* en detalle para ver cómo se puede *frenar* el peligroso *viaje* de las células cancerosas por el torrente sanguíneo para *colonizar* otros lugares del cuerpo. (ep70)³⁹

In (22) the particularly high density of metaphorical expressions to introduce the topic of the article, may have a twofold purpose: to present metastasis in a amenable and entertaining way and to provide some general information about the process. Research into metastasis is framed as a specific *front* in the *fight* against cancer. This research consists of a detailed *interrogation* of the intricate cellular *mechanisms* in the organism. This questioning of biological processes evokes a crime scenario of police investigation. In addition, the process of metastasis is first defined as *dissemination* and then as a

³⁹ The *fight* against metastasis, the *dissemination* of cancer to organs other than the one originally affected, has become the most active cancer research *front*. The intricate cell *mechanisms* are subjected to detailed *interrogation* to see how to *put a brake* on the dangerous *journey* of cancer cells through the bloodstream to *colonise* other sites in the body.

dangerous *journey* to *colonise* different parts of the body. Thus, this text combines three of the four source domains presented earlier. However, these expressions seem largely compatible. Firstly, they all involve an underlying PATH schema. Moreover, the *journey* image is highly generic and while *dissemination* and *colonise* evoke two specific scenarios, metaphors of *colonisation* and *invasion* are also combined in the discourse of invasive plant species (see Larson *et al.* 2005).

The following excerpt also corresponds to the lead of an article reporting on the role of stem cells in the spread of breast cancer:

(23) Las células madre podrían desempeñar un papel importante en las metástasis, el proceso por el cual un tumor se *disemina* por distintos órganos. Es lo que indica un trabajo que publica hoy la revista científica *Nature*, que demuestra que algunas células madre derivadas de la médula ósea facilitan el que las células del cáncer de mama se vuelvan *invasivas* y logren *viajar* a otros órganos. (ep53)⁴⁰

In (23) again, metastasis is first described as the *dissemination* of cancer cells. When introducing the general aspects of the investigation, more detail is provided about the stages of metastasis: stem cells make cancer cells *invasive* (i.e. that they acquire the potential to metastasise) and capable of *travelling* to other organs.

Example (24) also illustrates how the various stages of malignant progression are conveyed by means of metaphorical language, this time providing slightly more detail about the different phases:

(24) “Las metástasis son vistas a menudo como el *paso* final de la progresión del tumor”, explicó Weinberg, un proceso complejo que exige que las células tumorales se vuelvan *invasivas*, *viajen* por el sistema linfático y los vasos sanguíneos a órganos distantes, generen micrometástasis y finalmente se reproduzcan y se ‘*asienten*’ en el nuevo *destino*, *colonizándolo*. (ep53)⁴¹

In (24) the different stages towards the formation of a secondary cancer are described via metaphorical language. First, cancer cells need to become *invasive* (i.e. spread to

⁴⁰ Stem cells might play an important role in metastasis, the process by which a tumour is *disseminated* to different organs. This is indicated by a study published today in the scientific journal *Nature*, which shows that some stem cells derived from the bone marrow enable breast-cancer cells to become *invasive* and to *travel* to other organs.

⁴¹ “Metastases are often seen as the final *step* in tumour progression”, explained Weinberg, it is a complex process that requires tumour cells to become *invasive*, to *travel* through the lymphatic system and blood vessels to distant organs, to generate micrometastases and finally to reproduce and ‘*settle*’ in their new *destination* colonising it.

adjacent tissue). Second, they *travel* through the lymphatics and blood vessels, and finally, they *settle down* and *colonise* the new *destination*.

It should be noted that in (24) there is a slightly greater elaboration of the metaphorical themes than in (23). Whereas in (23) there is only one metaphorical expression instantiating each of the three source domains employed in the excerpt (DISSEMINATION, INVASION AND COLONISATION and JOURNEY), in (24) the two source domains present, INVASION AND COLONISATION and JOURNEY, are elaborated through related metaphorical expressions to account for the complex process of metastasis: *invasivas, asienten, colonizar; viajar, destino*.

Although the previous examples have shown how the different metaphorical expressions may occur in clusters, the same metaphors or other related terms may also appear at different points of the texts, thus providing the text with lexical coherence. Text (25) is an extended example from *El Mundo* illustrating how the different metaphorical themes are combined and used throughout the text in addition to other metaphorical expressions involving personification in general.

(25) El científico Joan Massagué pone al día de las bases moleculares por las que el cáncer se *disemina* a otros órganos

Es lo peor del cáncer. Si el crecimiento de los tumores malignos se circunscribiera únicamente a su lugar de origen, la letalidad de esta patología sería posiblemente mucho menor de la que tiene ahora. Sin embargo, las células cancerosas *se escapan* del tumor primitivo para *colonizar* otros órganos a distancia y *acabar* con el paso del tiempo *con* la vida de los pacientes oncológicos.

El español Joan Massagué, [...] es uno de líderes en la comunidad científica en la búsqueda de genes *responsables* de que las células cancerosas *viajen* desde donde se han iniciado al pulmón, el hígado, los huesos o el cerebro, que son los lugares en los que *colonizan* de forma más frecuente. Al final, este tipo de *asalto* es, en general, la máxima razón de la mortalidad de la enfermedad maligna [...].

Según estos investigadores ya hay decenas de genes que toman parte activa en los tres estadios básicos en los que se puede resumir el proceso metastásico. El primero es el de la iniciación de la *colonización* desde el tumor primitivo, el segundo es el de la progresión de las células malignas hasta lugares distantes y el tercero el de la virulencia de estas células una vez que han alcanzado el objetivo. (em55)⁴²

⁴² The scientist Joan Massagué gives an update on the molecular basis whereby cancer is *disseminated* to other organs.

It is the worst part of cancer. If the growth of malignant tumours were restricted to their place of origin, this disease would possibly be far less lethal than it is now. However, cancer cells *escape* from the primary tumour to *colonise* other distant organs and in time to *put an end* to cancer patients' lives.

The Spaniard Joan Massagué, [...] is one of the leaders in the scientific community in the search for the genes *responsible* for cancer cells *travelling* from where they originated to the lung, liver, bones or brain,

In (25), although the most recurrent notion is that of *colonisation*, other metaphorical expressions are present. The process itself, as was seen in the examples from *El País* (22 and 23), is first introduced in the subheadline as the *dissemination* to other organs. In the lead, cancer cells are portrayed as if they were volitional agents: they *escape* from their original location with an aim in mind: to *colonise* distant organs. The lead researcher of the investigation is said to be looking for the genes *responsible* for cancer cells *travelling* to four organs which are frequently *colonised*. The whole process is then summarised by saying that it is an *assault*. This unconventional metaphorical expression, can be seen as an elaboration on the topic of *colonisation*, implying that it is not a peaceful occupation of virgin territory.

This section has shown how metaphorical expressions from the four source domains introduced in the previous section are combined in the Spanish subcorpus to explain metastasis, often appearing in close proximity, and thus forming clusters, but also stretching through the texts.

7.4.3 Elaboration and extension

The quantitative analysis in section (7.4.1) has shown that most of the metaphorical expressions used in the popularisation of metastasis are fairly similar to those used in scientific genres. However, in some texts less conventional metaphorical expressions from the above-mentioned source domains are employed, thus elaborating and extending the technical concepts. The examples presented in this section can be seen as instantiations of what Knudsen (2003) refers to as the ‘opening up’ of technical metaphors. In the following I will discuss this creative elaboration in three of the metaphorical systems – INVASION AND COLONISATION, DISSEMINATION, and JOURNEY – that characterise the reporting of metastasis in the Spanish press.

which are the sites most often *colonised*. In the end, this kind of *assault* is, in general, the main reason for the mortality of this malignant disease [...].

According to these researchers there are dozens of genes which take an active role in the three basic stages into which the metastatic process can be summarised. The first is the initiation of *colonization* from the primary tumour, the second is the progression of malignant cells to distant sites and the third is the virulence of these cells once they have reached their target.

Some of the linguistic metaphors in example (26) could be related to the INVASION AND COLONISATION source domain. It should be noted, however, that the more conventional expressions attributable to this metaphorical system (*invade* and *colonise*, and their derived nominal and adjectival forms) are not present in the text. Rather, the INVASION AND COLONISATION scenario is evoked in an original way by other metaphorical expressions in the lead and in the third paragraph to bring the abstract notion of metastasis closer to the reader by presenting it in an attractive narrative form.

(26) Como si fuesen *exploradores* que se lanzan a *reconocer* el terreno de ‘*avanzadilla*’, los tumores liberan pequeñas membranas capaces de alterar el tejido que los rodea para facilitar la propagación del cáncer [...]

Estas microvesículas (denominadas exosomas) se asemejan a pequeños *sacos* que se desprenden del tumor y van cargados de algunas sustancias. Entre ellas, ciertas proteínas angiogénicas y moléculas que le permiten ir ‘*allanando el terreno*’ en los tejidos circundantes para facilitar la expansión de las células sanguíneas. Es decir, *manipulan* el entorno para favorecer el crecimiento del tumor, *burlando la vigilancia* del sistema inmune. (em54)⁴³

The vesicles released by the tumours are said to be *scouts* which at the onset of the metastatic process set out on a *reconnaissance mission* to explore and prepare the unknown territory, which is supposedly hostile and ready to defend itself. However, since the INVASION AND COLONISATION theme is indirectly evoked, the overall effect is less aggressive than an outright WAR scenario.

In contrast, in (27) the INVASION AND COLONISATION scenario is more clearly exploited. The article reports on a case study in which the scientists used the patient’s own immune system to treat his cancer:

(27) En definitiva, los CD4 [linfocitos] han resultado tener más funciones contra el *invasor* tumoral de lo que se creía en un primer momento y el caso recogido en el *NEJM* representa uno de los colofones de esta andadura.

Sin embargo, a pesar de los avances realizados en el conocimiento de las *estrategias ‘bélicas’* que emplea el tumor para *ganar terreno* y el organismo para *erradicarlo*, desarrollar el *arma* definitiva que *acabe con* el cáncer no es sencillo. (em46)⁴⁴

⁴³ As if they were *scouts* sent out in an *advance party* to *reconnoitre* the *land*, tumours release small membranes capable of altering the tissue surrounding them to facilitate propagation of the cancer [...] These microvesicles (called exosomes) resemble small *bags* which become detached from the tumours and are laden with substances. These substances include certain angiogenic proteins and molecules that allow the ‘*levelling out of the ground*’ in the surrounding tissues so as to facilitate the spread of blood cells. That is, they *manipulate* the environment to favour tumour growth, *outsmarting* immune system *surveillance*.

⁴⁴ In conclusion, the CD4 cells [lymphocytes] have proved to have more functions against the tumour *invader* than was first thought and the case reported in the *NEJM* represents one of the high points along this path.

In this fragment, the process of metastasis is expressed in highly metaphorical language in a cluster in which tumours are depicted as *invaders* using *warlike strategies* to *gain ground* on the organism. Although the use of scare quotes minimises the WAR scenario and the *defense* is portrayed as against an *invasion* of the body through the euphemistic verb *eradicate*, the framework is essentially one of violent confrontation and thus, may be upsetting for some patients.

In (28) Paget's 'seed and soil' hypothesis is spelt out to provide the background information for the correct understanding of the reported scientific achievement:

(28) Hasta ahora se suponía que los órganos y tejidos participaban de alguna manera en la propensión de ciertos tipos de cáncer a metastatizar. Además, los investigadores sospechaban que los huesos ofrecían un *terreno* especialmente '*abonado*' para las células malignas, probablemente mediante la producción de ciertas moléculas que permiten a las células tumorales '*albergar*' en ellos y generar metástasis, una de las complicaciones más frecuentes y mortíferas de muchos tipos de cáncer.

En este caso, los estudios con ratones que padecían cáncer de piel han permitido observar el papel crucial de una proteína denominada RANKL, que se produce en elevadas cantidades en la médula ósea. "Se trata de una molécula que *atrae* a las células cancerosas hacia los huesos", ha explicado Penninger a la agencia Reuters. (em18)⁴⁵

In this excerpt the journalist explains that the bones are thought to provide a specially *fertilised soil*, where cancer cells can *lodge*, as a background to the rest of the story. The researchers have found further evidence supporting this theory by the identification of a molecule (RANKL) in the bone marrow which appears to *attract* cancer cells towards the bones. Although this last expression does not belong to the DISSEMINATION source domain, against the background presented it helps to understand how in metastasis the *soil* plays an active role in the process.

The essence of Paget's hypothesis, the fact that the organs provide a conducive environment for cancer to develop, is also creatively expressed in the following

However, in spite of the advances in the understanding of the '*war*' *strategies* employed by the tumour to *gain ground* and by the organism to *eradicate* it, developing the ultimate *weapon* to *finish off* cancer is not a simple matter.

⁴⁵ Until now, it was assumed that organs and tissues somehow participated in the propensity of certain types of cancers to metastasise. In addition, researchers suspected that bones offered a specially '*fertilised*' *soil* for malignant cells, probably by producing certain molecules that allow tumour cells to '*lodge*' in them and generate a metastasis, one of the most frequent and lethal complications of many types of cancers.

In this case, studies in mice that suffer skin cancer have revealed the crucial role of a protein called RANKL, which is produced in large quantities in the bone marrow. "It is a molecule that *attracts* cancer cells towards the bones"; Penninger explained to Reuters.

example but this time by drawing linguistic metaphors from the JOURNEY source domain:

(29) Las metástasis no se producen ‘al tuntún’, ni tan aleatoriamente como a veces podría pensarse. Este *viaje* de las células tumorales a otros órganos del cuerpo humano, [...], está estrictamente *dirigido* por complejos *mecanismos* celulares. Sólo ahora, y después de décadas de investigaciones, parecen vislumbrarse algunas de las claves que permitirían *frenar* este proceso.

La última evidencia sobre las metástasis del cáncer de mama hasta los pulmones (su *destino preferido*) lleva de nuevo la firma del científico español Joan Massagué. (em42)⁴⁶

In (29) the article opens with a description of metastasis as a *journey* which is *guided* by complex cellular *mechanisms*. In addition, the tendency of cancer cells to metastasise in the lungs is expressed by stating that cancer cells have *favourite destinations*. Further down in the article cells are said to *campar a sus anchas*, which is an idiomatic expression in Spanish. ‘Campar’ means to camp and ‘a sus anchas’ at ease, comfortably.

Finally, in example (30), the fact that cancer cells spread through the blood vessels is metaphorically conveyed by elaborating on the JOURNEY source domain:

(30) Las mutaciones que contienen algunas pocas células, sin embargo, favorecen un *viaje* casi imposible en el que deben sobrevivir en el torrente sanguíneo (se han detectado células malignas que emplean a las distintas células de la sangre como *vehículo de transporte*), *vencer* los *ataques* del sistema inmunológico, adherirse y traspasar los capilares, adaptarse a un nuevo medio [...] ahí volver a proliferar hasta formar un nuevo tumor. Todas estas acciones tienen lugar, “muy probablemente”, según Massagué, gracias a la participación de medio centenar de genes. De ellos, tan solo 18 se han identificado como *participantes* en el *trayecto*. Otros 30 participan exclusivamente, al parecer, en el *mecanismo de nidificación* en los pulmones. (ep48)⁴⁷

In (30), metastasis is said to be an impossible *journey* in which some malignant cells use blood cells as a *vehículo de transporte* (‘means of transport’). The JOURNEY

⁴⁶ Metastases do not occur ‘without rhyme or reason’, nor as randomly as might be thought. This *journey* of tumour cells to other organs in the human body, [...], is strictly *guided* by complex cellular *mechanisms*. Only now, after decades of research, are we beginning to glimpse some of the keys that might bring this process to a *halt*.

The latest evidence about breast cancer metastases to the lung (their *favourite destination*) again bears the signature of the Spanish scientist Joan Massagué.

⁴⁷ The mutations present in a few cells, however, favour an almost impossible *journey* in which the cells have to survive in the bloodstream (some malignant cells have been seen to use different blood cells as a *means of transport*), *beat off* the immune system’s *attack*, bind to and cross the capillaries, adapt to a new environment [...] and proliferate there again until they form a new tumour. All these actions “very probably” take place, according to Massagué, thanks to the participation of around fifty genes, 18 of which have been identified as participants in the *journey*. Another 30 only seem to participate in the *nesting mechanism* in the lungs.

metaphors are combined with expressions from other source domains to explain the role of two types of metastasis-related genes. The first set of 18 genes appear to be involved in the movement of cancer cells through the blood vessels. To describe this process the JOURNEY metaphors are combined with WVA metaphorical expressions giving rise to a more complex scenario in which cancer cells can be seen as participating in a dangerous and difficult *journey*. The second set of 30 genes appear to play a role in establishing the tumour cells in the new organ. In this case, the journalist resorts to the *nesting* metaphor to highlight their different role in the metastatic process.

Although in most of the texts expressions from the metaphorical systems used to describe metastasis are fairly conventional, these examples show that they can be creatively exploited to achieve particular discursive effects. In (26) and (29) the expressions cluster around the lead of the article to initiate the narrative in an evocative and vivid way for the reader. In addition, in (28) and (29) the linguistic metaphors are exploited to explain particular aspects of metastasis.

7.4.4 Metaphorical expressions involving personification

In contrast to the English subcorpus, in the explanation of metastasis the Spanish articles often delve deep into the particular biological interactions occurring within cancer cells or between cancer cells and other molecules in their environment. This often involves the exploitation of metaphorical expressions that personify cancer cells and other biological entities (genes, proteins).

Two texts, one from each of the newspapers analysed, report on the same discovery concerning the identification of a gene which appears to play an important role in the development of the metastatic ability of breast cancers. According to the articles, the gene (SATB1) coordinates more than 1,000 breast cancer genes. In both articles, the gene is criminalised. In (31) it is said to be a *mafioso* gene in the headline and a *mafia chief* in the lead:

(31) Un gen '*mafioso*' controla al menos otros 1.000 genes en el cáncer de mama

Un solo gen actúa como un *jefe mafioso* y controla el comportamiento de al menos otros 1.000 genes en las células de los tumores de mama más agresivos, han descubierto investigadores estadounidenses. (ep60)⁴⁸

Similarly, in (32) it is said to be the *crime boss* in the headline and in the body of the text it is referred to as a *pernicious leader*:

(32) El jefe del crimen se llama SATB1

[...] El equipo de Kohwi-Shigematsu ha demostrado que es posible desactivar a este 'líder' *pernicioso* para frenar la proliferación de las células cancerosas e incluso devolverles su apariencia normal. (em40)⁴⁹

However, neither of the articles develops the crime scenario. Thus, it could be argued that these metaphorical expressions (particularly, those appearing in the headlines and the lead) are used as attention-grabbing devices. In addition, they help to establish a frame of reference for the readers to understand that the interactions within the body are governed by a hierarchical organisation and that this gene is acting to the detriment of the organism.

In (ep58) it is the tumour cells that are portrayed as participating in delinquent activities:

(33) La labor del equipo de Massagué se centra en identificar el conjunto de genes, y ahora también microARN, que las células de un tumor *piratean* para desarrollar metástasis. (ep58)⁵⁰

This example is from an article reporting on a study investigating the role of microRNAs (molecules) in metastasis. Tumour cells are criminalised and said to make *pirate copies* of the microRNA molecules, an image that evokes the illegally recorded songs and films that are spread via the Internet (body) and by other means, in competition with the authentic products (normal microRNAs).

This article is complemented by a short text in which the journalist introduces the views of another Spanish scientist, Antonio Giráldez, who also studies microRNA molecules. The subhead to this text reads: *Un programa pirateado* ('A cracked program'). In a

⁴⁸ A '*mafioso*' gene controls at least another 1,000 genes in breast cancer.

A single gene acts like a *mafia chief* and controls the behaviour of at least another 1,000 genes in the cells of the most aggressive breast tumours, American researchers have discovered.

⁴⁹ The *crime boss* is called SATB1

[...] Kohwi-Shigematsu's team have shown that this *pernicious 'leader'* can be stopped to bring the proliferation of cancer cells to a halt and even to restore their normal appearance.

⁵⁰ The work of Massagué's team is focused on identifying the set of genes, and now also microRNA, of which the tumour cells make *pirate copies* in order to develop metastases.

direct quotation from the researcher, this metaphorical theme is developed and cancer cells are criminalised as *crackers* and said to *crack into* the cellular *program* in order to use it for their own benefit, that is, to *colonise* other tissues and expand. Thus, it appears that the journalist has taken the computer metaphor from the interview with Giráldez and expanded it to explain Massagué's discovery:

(34) Un *programa pirateado* [...] “Es posible imaginar que la principal función para los microRNA asociados con metástasis no es controlar la metástasis en sí, sino controlar el movimiento de las células durante el desarrollo. Las células cancerosas se aprovechan de este *programa* celular y lo *piratean* para usarlo en su propio beneficio, en este caso *colonizar* otros tejidos y expandirse”. (ep58)⁵¹

The idea of biological entities being illicitly modified by cancer cells is also present in a group of four articles reporting on the same discovery (3 from *El País* and 1 from *El Mundo*). In these texts, however, cancer cells are said to alter the moral code of a group of molecules. The discovery involved the description of the role of cytokines in the spread of breast cancer to the lungs. These molecules normally constrain cell proliferation by controlling growth or inducing cell death (apoptosis), but paradoxically, they can also spur metastasis if cancer cells acquire resistance to their signals (Streuli 2006: 379-380).

Three of the texts base their argument around the same notion, which is that of cytokines becoming *pervirtidas* (‘perverted’) by cancer cells:

(35) Los científicos han identificado el proceso mediante el cual las células de este tumor se reproducen y se extienden al pulmón, “*pervirtiendo*” una hormona cuya función básica es impedir la división celular. El estudio [...] determina cómo las células *utilizan* esta molécula [...] en beneficio propio para que actúen a favor del tumor. (ep62)⁵²

(36) Se trata de TGF-beta [...], una citoquina que [...], regula el crecimiento y el movimiento celular [...]. En condiciones normales, esta hormona debería *frenar* el proceso tumoral; sin embargo, todo indica que las células malignas son capaces de ‘*pervirtirla*’ y *utilizarla* en su propio beneficio para causar las metástasis. (em42)⁵³

⁵¹ A *cracked program* [...] “It is conceivable that the main function of the microRNAs associated with metastasis is not to control metastasis itself but to control cell movement in its development. The cancer cells take advantage of this cell *program* and *crack into it* to use it for their own benefit, in this case to *colonise* other tissues and spread.

⁵² Scientists have identified the process by which cells from this tumour reproduce and spread to the lung, by “*pervirting*” a hormone whose basic function is to prevent cell division. The study [...] determines how the cells *use* this molecule [...] for their own benefit so that they act in the tumour's favour.

⁵³ It is TGF-beta [...], a cytokine which [...] regulates cell growth and movement [...]. In normal conditions, this hormone should stop the tumoral process; however, everything indicates that malignant cells are able to ‘*pervert*’ it and *use* it for their own benefit to cause metastasis.

The metaphorical quality of the expression is signaled by means of scare quotes in three instances in two texts but not in another. This text includes an additional metaphor that the TGFb becomes an ‘ally’ of cancer, thus evoking a war scenario in which subversion might be better than perversion. The fourth text does not include the allusion to perversion but indicates that the tumour cells ‘appropriate’ the cytokine to work for them instead of against them. It should be noted that Spanish ‘apropiarse’ has the negative connotation of taking possession of, or taking over, something in an illegal or abusive manner.

The examples commented on in this section illustrate how in the reporting of metastasis in the Spanish press the biological entities which somehow participate in the process are vilified. This is consistent with what was observed for the English subcorpus. The criminalisation of the agents involved in the process of metastasis can be seen as a strategy to introduce the inner processes taking place at a microlevel in an amenable and amusing way for the readers while serving to explain more abstract issues involved in the spread of the disease.

7.4.5 Sample text analysis

This section provides an analysis of text (ep49) to illustrate how the different metaphorical themes interrelate and function in the discourse. The story, which was deemed of sufficient importance to be reported on the front page of the printed edition of *El País*, is one of the richest in metaphorical expressions for metastasis in the Spanish subsection of the corpus.

The article’s headline, which reads ‘The scientist Joan Massagué discovers the key to lung metastasis’, introduces the central topic, metastasis, but also signals the importance of the scientific discovery that motivates the news item. The subhead provides a very brief summary of the article ‘Four genes coordinate to facilitate the *dissemination* of a tumour from the breast’. The relevant agents in the story, the genes, are personified (coordinate) and, instead of the technical term, the journalist resorts to the *dissemination* metaphorical expression.

Sample text 5. El científico Joan Massagué descubre la clave de la metástasis de cáncer al pulmón (ep49)

El científico Joan Massagué descubre la clave de la metástasis de cáncer al pulmón

Cuatro genes se coordinan para facilitar la *diseminación* de un tumor desde la mama

Para que surja una metástasis, la *diseminación* de un cáncer, una célula tumoral debe realizar un largo y peligroso *viaje* y tiene que hacerlo en unas condiciones precisas para que su *misión* última, la formación de un nuevo tumor en un órgano distante, tenga éxito. Esas condiciones, de acuerdo con los resultados de un estudio sobre el cáncer de mama liderado por Joan Massagué, dependen de la activación anómala de unos pocos genes. Gracias a ellos se forman nuevos capilares por donde *escapa* la célula tumoral del tumor primario y se *abre paso* hasta alcanzar el pulmón.

El equipo del investigador español Joan Massagué, director del programa de Biología y Genética del Cáncer en el prestigioso Memorial Sloan-Kettering Cancer Center de Nueva York (MSKCC) y director adjunto del Instituto de Investigación Biomédica de Barcelona (IRB), ha identificado hasta la fecha un paquete de 18 genes fuertemente *implicados* en la aparición de metástasis. De todos ellos, según su nuevo trabajo, la acción conjunta de tan sólo cuatro provoca al menos dos fenómenos esenciales para que las metástasis tengan lugar. Por un lado, la formación de nuevos vasos sanguíneos alrededor del propio tumor y, del otro, la *perforación* de los pequeños capilares que proporcionan alimento y oxígeno a un órgano determinado. En el estudio de Massagué, que hoy publica la revista *Nature*, los órganos afectados son las mamas y los pulmones.

Los cuatro genes estudiados dan lugar a la formación de sendas proteínas “bien conocidas”, describía ayer Massagué en conversación telefónica. Se trata de la eipirregulina, COX2 y de dos variantes de metaloproteasas que la célula excreta en su espacio exterior. De estas proteínas era conocida su *implicación* en procesos inflamatorios y su presencia en procesos tumorales, pero se ignoraba el papel esencial que juegan en la *diseminación* de tumores y, aún más, que se precisara de la actividad conjunta de todas ellas. “Es como una *caja de herramientas*”, ilustra Massagué. “*Para hacer un agujero en la pared necesitas una escarpia y un martillo, pero ambos deben usarse conjuntamente*”.

La acción conjunta de estas cuatro proteínas provoca, según se ha visto en experimentos realizados en 738 tumores de mama humanos inducidos a ratones, la formación de nuevos vasos sanguíneos alrededor del tumor, fenómeno conocido como angiogénesis. Gracias a estos nuevos vasos, el tumor se nutre de oxígeno y alimentos adicionales, factor que favorece su crecimiento. Pero estos vasos presentan algo así como una imperfección, son porosos. A través de los poros *escapan* las células tumorales hacia el torrente sanguíneo. “Sabíamos que por cada centímetro cúbico de un tumor agresivo [tamaño equivalente a un garbanzo] puede llegar a *escaparse* hasta un millón de células malignas”, señala Massagué. Lo que no se sabía era exactamente cómo ni cuáles eran los genes y proteínas *implicados*.

También se sabía que, una vez alcanzado el torrente sanguíneo, las células tumorales deben estar “suficientemente preparadas” para resistir la *embestida* del sistema natural de defensas y, en un momento dado, salirse del sistema circulatorio para *anidar* en un órgano distante. El trabajo publicado por Massagué explica cómo la célula maligna se sale de los capilares que alimentan a los pulmones y propone claves para entender su *resistencia* en un medio tan hostil como la sangre.

De nuevo, es la acción conjunta de las cuatro proteínas lo que permite que una célula cancerosa *se abra paso* literalmente entre las células que forman la pared de un minúsculo capilar. Y lo que se ha visto es que lo hacen casi como resbalando entre las sustancias que *cementan* las células del capilar.

The lead opens with information on the process of metastasis, again defined as *dissemination*, which, it is said, requires a tumour cell to make a long and dangerous *journey* under very precise conditions in order to succeed in its *mission*. This not only establishes the topic of the article but also introduces a second metaphorical system JOURNEY. As we have seen in other popularisations, the lead also begins to address how the new discovery throws light on the process of metastasis: it depends on the *activation* of a few genes that help to form new capillaries round the original tumour, from which cancer cells are able to *escape* and *open their way* to the lung. The use of the JOURNEY frame can be seen as a strategy to capture the attention of the readers by presenting the topic in the dramatic terms of an adventure story: ‘dangerous’, ‘mission’ and ‘escape’.

The next two paragraphs form a first cycle of the body of the article and stress the novelty of the discovery of Massagué’s team. Of 18 genes previously known to be directly *implicated* in metastasis, four play a key role in two phenomena essential for the process to occur: the formation of new blood vessels around the tumour in the breast and the *perforation* of the small capillaries supplying food and oxygen to a specific organ (lung). The second of the paragraphs goes on to explain that these four genes give rise to four proteins that were previously known to be *implicated* in inflammatory processes and to be present in tumour processes, but whose combined action in the *dissemination* of tumours was unknown. Although these paragraphs only contain a few metaphorical expressions, the use of ‘implicated’ suggests that the ‘mission’ is illegal or subversive, the appearance of ‘perforation’ for the moment remains unexplained, but the iteration of ‘dissemination’ provides a link to the subhead and lead, drawing the text together. The journalist then closes this cycle by quoting Massagué, who explains through an analogy why the coordinated action of the four proteins is required: ‘It’s like a toolbox’ ‘To make a hole in a wall you need a hook and a hammer, but both must be used together’. Massagué’s analogy with a familiar Do-It-Yourself activity provides the key to the interpretation of the rest of the text, in which the actions of the proteins at microscopic level are explained.

The next three paragraphs constitute a second cycle of the body that describes the role of the proteins in greater detail and sees the return to the ‘journey’ and ‘mission’ frame and the introduction of new metaphorical expressions from the MIGRATION and WVA source domains.

The first of these paragraphs explains that the new blood vessels formed with the help of the proteins not only sustain the primary breast tumour but also present a defect (they are porous), and allow the cancer cells to *escape* – as many as a million from a tumour the size of a chickpea, as Massagué points out in a quote. The proteins, therefore, are the ‘tools’ that make the ‘holes in the wall’ to set the cancer cells on their journey.

The second paragraph in the cycle develops the ‘dangerous journey’ scenario. En route from the breast to the lung, the bloodstream is portrayed as a ‘hostile environment’ so that the tumour cells must be “sufficiently *well-prepared*” to withstand the *attacks* of the natural *defence* system’. The fact that the writer uses ‘embestida’ (attack, but normally associated with animals) transforms the journey into a migration of birds or small animals which show ‘resistance’ in the ‘hostile environment’ before finding a ‘nesting’ place in a distant organ.

The third of the paragraphs in this cycle describes how the cancer cells manage to leave the bloodstream to complete the journey. The four proteins, again acting as ‘tools’, allow the cells to ‘literally break through between the cells in the capillary wall’ and they do so ‘between the substances that cement the capillary cells’. Thus, the DIY analogy is developed since the capillary cells are bricks and the substance on which the proteins (tools) act are cement.

The rest of the article consists of two paragraphs that refer to another related study by Massagué and his co-workers, in which the only metaphorical reference is to gene ‘signature’. These paragraphs form the tail of the pyramid and could easily be removed for space requirements. Finally, there is a concluding paragraph entitled ‘El *viaje* del cancer’ (‘Cancer journey’), which summarises the article in basically non-metaphorical language, with only ‘escape’ and ‘nesting’ reappearing to mark the beginning and the end of the metaphorical ‘journey’.

This article has shown how three of the four metaphorical systems used to represent metastasis (DISSEMINATION, MIGRATION and JOURNEY) are interconnected. In this case, the first is only used as a conventional metaphorical synonym for metastasis. However, the JOURNEY and MIGRATION frames are extensively developed according to the local requirements in the text. Initially, genes and cancer cells are personified so that the

JOURNEY frame is the more appropriate, allowing the journey to be dramatised as a dangerous mission with subversive or illegal overtones. Later, the MIGRATION frame is preferred as the final stage of the metastatic process is depicted as ‘nesting’. Also drawn into the description are a few allusions to the WVA source domain although these are attenuated and encompassed within the ‘hostile environment’ in which the cancer cells move. However, the most striking image is the DIY analogy initially provided by the scientist but then skilfully developed by the journalist to explain the key role of the four genes and their respective proteins. They are the tools from the toolbox that provide the openings that initiate and complete the movement of the tumour cells from breast to lung.

7.5 Summary

The present chapter has dealt with the metaphors used in the recontextualisation of metastasis. The first section (7.2) provided some general information about the process and reviewed previous work related to the metaphors for metastasis identified in specialised discourse since these metaphors are also found in non-expert genres. It has also been pointed out that, in the context of metastasis, the boundary between the literal and the metaphorical is somewhat fuzzy and, in this regard, reference to Knudsen’s work on metaphors in science and popular genres has also been made since the concept of ‘opening up’ of metaphors is particularly useful in accounting for metastasis.

Sections (7.3) and (7.4) presented the results of the analysis of the English and Spanish press. Overall, it could be argued that the coverage of the process and the images used for its explanation showed marked variation in terms of cross-linguistic comparison.

The quantitative analysis of the English subsection showed that the process is presented with little metaphorical aid, although metaphorical expressions from the INVASION AND COLONISATION source domain were the most prevalent, in addition to some expressions instantiating the MIGRATION source domain and one realisation of the JOURNEY theme. The scant presence of metaphorical expressions in *The Guardian* newspaper was particularly striking. It was suggested that the absence of metaphorical expressions

related to the notion of colonisation could be explained by the fact that the British Empire remains controversial and a taboo topic for some sections of English society. This, however, should be verified by further analysis of a larger corpus. In spite of the relative absence of metaphorical terms to convey metastasis in the English texts, some elaboration could be found through the personification of biological entities which were vilified and portrayed as participating in delinquent activities. Although the sample text chosen for detailed analysis was not representative of the coverage of metastasis the English subcorpus, it was selected because it made a particularly original and pedagogical use of intertextual metaphor and other metaphorical expressions.

In the Spanish subcorpus, the process of metastasis was more prominent and the articles displayed a wider use of images involving the movement from one place to another. The most prevalent metaphorical systems were the INVASION AND COLONISATION and the DISSEMINATION source domains, both of which derive from scientific discourse, followed by the JOURNEY and MIGRATION source domains. In the Spanish articles, metaphorical expressions from these four source domains are combined in clusters or stretched throughout the texts. In this way, they not only help to explain particular aspects related to metastasis but also provide the articles with cohesion because they all involve an underlying PATH schema. Although in general the metaphorical expressions employed are fairly conventional, a number of examples served to illustrate how, in some texts, the metaphorical expressions were creatively elaborated in what Knudsen (2003) calls the 'opening up' of technical metaphors. As with the English texts, when dealing with the specific interactions between different biological entities that promote metastasis, the relevant agents were personified and presented as involved in delinquent activities or displaying immoral behaviour. Finally, a sample text was analysed in detail to illustrate better the ways in which metaphorical expressions from different source domains interacted and functioned in the discourse.

Chapter 8

Apoptosis and its metaphors

The writer used a chilling phrase to describe traumatic hair-cell loss: '*exposure to damaging drugs or noises causes these hair cells to die with a kind of suicide program. They basically commit suicide in your ear*'. Is it possible, after all, that that rock band at Fillmore West provoked mass suicide in my inner ears? David Lodge, *Deaf Sentence*

8.1 Introduction

This chapter is devoted to the presentation of the different metaphorical expressions used to explain or describe the process of apoptosis in the corpus of press popularisations. Section (8.2) provides a definition of apoptosis and accounts for the metaphors employed to depict this process in the scientific literature. This overview of the metaphors for apoptosis in specialised genres is relevant because many of those used in scientific genres are *recontextualised* in popular accounts of the process. The following sections (8.3 and 8.4) deal with the different metaphorical expressions related to the concept of apoptosis identified in the two subcorpora, first in the English and then in the Spanish subcorpus. For each language I provide quantitative data for the most predominant metaphorical expressions. Then, I describe the most recurrent ways in which the process is defined, paying attention to how appropriate or inappropriate certain metaphors are for the explanation of apoptosis. Finally, I discuss some more creative examples. For the analysis of apoptosis in the English press, I also include a sample text analysis. This section has not been included in the Spanish analysis because apoptosis was not dealt with in detail in any of the texts. Section (8.5) provides an overview and summary of the whole chapter.

8.2 Apoptosis and its metaphors in specialised genres

It is not the aim of this section to give a full account of the complex process of apoptosis but, for the purpose of this study, suffice it to say that apoptosis is a genetically regulated special kind of cell death, essential for normal development of an organism, maintenance of tissue homeostasis, and removal of damaged cells from the body. During pregnancy, for example, cell death by apoptosis takes place in the tissue which connects the toes and fingers of the foetus, thus leading to the correct formation of the digits. In a human adult, about 50 billion cells die daily and the body replaces an estimated 70 kg of cells annually in order to maintain tissue balance. Finally, in normal conditions, a cell will die if mistakes occur during cell division.

Deregulation of this process – too much or too little apoptosis – can give rise to a number of pathological conditions. Degenerative diseases like Alzheimer's, Huntington's and Parkinson's, for instance, are associated with an excess of apoptosis, whereas cancer is related to a lack of apoptosis taking place (Pelengaris and Khan 2006b: 252). This is the main reason why apoptosis has been described as one of the 'Hallmarks of Cancer' (Hanahan and Weinberg 2000). In contrast to healthy cells, cancer cells evade apoptosis and thus continue to divide, giving rise to the uncontrolled proliferation of cancer cells. Currently, an increasing amount of research is being devoted to the understanding of this process and to the identification of substances that can trigger this mechanism.

The different terms employed to refer to or describe cell death in general – and apoptosis in particular – have caught the scientist's attention, and the lack of systematicity and consistency in their use has led to the creation of a *Nomenclature Committee on Cell Death* (Kroemer *et al.* 2005). The scientific community has also drawn attention to the metaphorical nature of the terms used for cell death, and experts in the field have discussed the connotations or associations that these expressions may evoke (Ameisen 2002; 2003, Melino *et al.* 2010). In this respect, Ameisen (2002) has expressed a common concern found in scientific circles, which is that of mistrust towards metaphorical language. In his article on cell death, Ameisen (2002: 368) quotes Lewontin, who warns that although "it is not possible to do the work of science without

using a language that is filled with metaphors [...] the price of metaphor is eternal vigilance” (Lewontin 2000: 3-4).

In order to illustrate some of the metaphors used to discuss apoptosis in the specialised literature, I include the following definition from an article published in the scientific journal *Nature*:

The most common and well-defined form of *programmed cell death* (PCD) is *apoptosis*, which is a physiological ‘*cell-suicide*’ programme that is essential for embryonic development, immune-system function and the maintenance of tissue homeostasis in multicellular organisms (Okada and Mak 2004: 592, my emphasis).

The three terms highlighted in italics in the Okada and Mak quotation are metaphorical. As argued below, ‘apoptosis’ is a case of catachresis, or lexical gap filling, and whereas ‘programmed cell death’ is not singled out and, thus, appears to be fully accepted, the expression of ‘cell-suicide’ is placed between scare quotes, signalling that it should not be taken literally. These terms, although often used interchangeably, are not synonymous:

The terms ‘programmed cell death’, ‘cell suicide’ and ‘apoptosis’ have each played a major role in expressing crucial conceptual advances concerning cell death and in promoting interest for the field, but it should also be noted that none of these terms are synonymous, that each one carries its own metaphors and philosophical implications, and hence some degree of ambiguity (Ameisen 2002: 368).

As will be shown, these expressions travel from specialised to more popular genres. Although in popularisation literature it may not be necessary to make fine-grained distinctions, it is nevertheless relevant to track down the origin, meaning, implications and potential ambiguities of the technical metaphors used in the field of cell death.

Apoptosis. Although the process of apoptosis was first observed in the nineteenth century (Lockshin and Zakeri 2001), the actual term was not coined until 1972, when a team of anatomical pathologists, Kerr, Wyllie and Currie, introduced it in an article written for the *British Journal of Cancer*. In a footnote, they acknowledged that Professor James Cormack of the University of Aberdeen had suggested the term and explained that ‘the word “apoptosis” (ἀπόπτωσις) was used in Ancient Greek to describe the “dropping off” or “falling off” of petals from flowers, or leaves from trees’ (Kerr *et al.* 1972: 241). The extant literature is not too clear as to which aspects motivated the coinage of the metaphor. Cortés Gabaudan (2009) clarifies that the word

is a compound term with a prepositional element *apó* (*από*) meaning ‘from’, and a noun *ptôsis* (*πτώσις*) meaning ‘fall’. The anteposition of the prepositional element specifies that the process takes place in a gradual manner. Analogously, in apoptosis cellular elements disappear progressively. Lockshin and Zakeri (2001) specify that the term was coined:

to focus attention on the yin-yang relationship of death to birth (that is, homeostasis is not maintained unless the loss of cells equals the birth of cells). The three [Kerr, Wyllie and Currie] argued that the ritualistic nature of cell death implied an organized and conserved mechanism: cell death or apoptosis was an aspect of life like any other (Lockshin and Zakeri 2001: 547).

Moreover, Majno and Joris (2004: 210) comment that the term was introduced to conjure up the *morphological*⁵⁴ contrast between death by apoptosis, whereby cells perish one by one in a process resembling the leaves falling from the trees, and the phenomenon of massive cell death, or necrosis.

Whatever the actual motivation was, the term ‘apoptosis’ reveals itself as an image metaphor based on the resemblance between the image of leaves and petals falling and the appearance of a cell undergoing apoptosis.⁵⁵ However, it should also be mentioned that from its inception, it was a dead metaphor (at least for people unfamiliar with the Ancient Greek language) (Eubanks 2000: 71). Therefore, in the remainder of the chapter, apoptosis will not be treated as metaphorical, but as the target domain to be explained.

Programmed cell death. As mentioned above, this term is often used as a synonym for apoptosis. Nevertheless, although apoptosis is a kind of ‘programmed cell death’, not all ‘programmed cell deaths’ occur by apoptosis. The term ‘programmed cell death’ was in fact introduced in the 1960s, before ‘apoptosis’ was coined, in the field of embryology with the meaning ‘to die on schedule’ (Lockshin and Zakeri 2001: 546, Majno and Joris 1995: 11). Apparently, there are two types of programme: one which indicates to the cells that they are ready to ‘die’; and one which specifies how to bring about the death, for instance, by apoptosis. In the experts’ own words: “The genetic program of

⁵⁴ In biology this term is used with the meaning of ‘the study of the form and structure of living things’.

⁵⁵ ‘Image metaphors’ involve the mapping of visual images, rather than complex conceptual domains (Lakoff and Turner 1989), and consist of a single ‘one-shot’ correspondence between a source image and a target domain instead of establishing multiple complex correspondences between domains (Semino 2008: 48).

programmed cell death is a clock specifying the time for suicide, whereas the genetic program of apoptosis specifies the weapons (the means) to produce instant suicide” (Majno and Joris 1995: 11).

Nevertheless, Ameisen (2002) notes that the etymological origin of the word *programme* (‘pre-written’) is ambiguous in biology because it suggests too strict a link between design and finality and confuses the existence of pre-written genetic information with the many ways this can be implemented by the cells and the body:

Accordingly, it is not the individual fate of each cell, its survival or its death, that is programmed (pre-written), but the capacity of each cell to induce or repress its self-destruction, depending on its present and past interactions with the other cells that constitute the body, and on the integrity of its internal components (Ameisen 2002: 368).

Cell suicide. The notion of cell suicide was developed in the 1950s after Christian de Duve (1959: 154) discovered the lysosome, an organelle located inside the cell. De Duve suggested that lysosomes might act like ‘suicide bags’ which exploded, killing the cell from within as a result (Majno and Joris 1995: 7). Apparently, this mode of cell death only took place in cells under very special circumstances (Majno and Joris 1995), but the metaphor has remained present in the scientific literature.

There is a general impression among scientists that the term ‘cell suicide’ is non-specialised and thus inappropriate for the specialised genres (Hidalgo Downing and Kraljevic Mujic 2009: 72). However, although this metaphor may be less frequent than the term apoptosis or the expressions ‘programmed cell death’ or ‘cell death’, ‘cell suicide’ is found in scientific discourse (Tercedor Sánchez 2000, Sheard 1997). Further support for this claim is provided by the fact that the metaphor is explicitly commented on in the scientific literature:

If we use the term ‘suicide’, we bring in, subliminally, anthropological implications derived from the social and philosophical field. We could say that the cells commit suicide for the benefit of the organism (altruistic death with social implications). We could also say that the organism kills innocent cells for its own selfish interest (egotistic death). Here, we should consider the definition of ‘self’ of the cell (I, cell, kill myself for the benefit of the organism). But do genes, cells and organisms have a ‘self’? (Melino *et al.* 2010: 5).

In a similar vein, Ameisen (2002) underscores the potential ambiguity of the anthropomorphic associations of the term while clarifying some misconceptions that it may give rise to:

The concept of ‘cell suicide’ or ‘self-destruction’ also provides some level of ambiguity, not only because of its obvious anthropomorphic reference, but also because it favours a confusion between the act of initiating self-dismantling (that the cell indeed performs by activating an intrinsic cell death machinery) and both the ‘decision’ to kill itself and the implementation of the death process (Ameisen 2002: 368).

Thus, the use of ‘suicide’ appears to be justified since this metaphor emphasises the fact that the cell has all the necessary components to bring about its death. Nevertheless, what triggers apoptosis – in Ameisen’s terms the ‘decision’ to bring about the death of the cell – is a different matter. From what I gather, the process can take place via two signalling pathways, extrinsic and intrinsic, which ultimately activate the caspases (Ameisen’s ‘intrinsic cell death machinery’), a set of enzymes which start dismantling the cell from within. A review of the range of components which activate the extrinsic and intrinsic pathways is beyond the scope of this study. Nevertheless, it should be mentioned that the scientific community is seeking to arrive at the complete understanding of the mechanisms of apoptosis in order to find ways to activate the apoptotic pathways in cancer cells. In this sense, as Spaeth (1998) has argued, a more apt metaphor would be that of ‘murder’:

Apoptosis has been called “cell suicide” [...] though this characterisation is partially misleading. In some instances the cell has been preprogrammed to die, and, indeed, this could be considered as a type of suicide. However, apoptosis in many cases is triggered by some outside stimulus [...] so the metaphor is properly closer to a forced suicide, or a murder (Spaeth 1998: 9).

The ‘suicide’ metaphor is often classed as alien to scientific discourse (Hidalgo Downing and Kraljevic Mujic 2009: 72). Nevertheless, as shown in the experts’ discussion, it has played an important role in advancing the field of cell death, and thus it could be argued that for some time the metaphor had a theory constitutive function.

Cell death. Another term found in the scientific literature is that of ‘cell death’ which can also appear in its verbal form (cells ‘die’). Although apoptosis is a form of cell death, there are many other ways in which a cell can ‘die’. Nevertheless, a question which could be raised is whether cells actually die. In this respect, the scientific literature takes the expression to be a metaphor:

‘Death’, for example, implies that there is only one death, that there is nothing after death, and that it is the final event. However, dead cells might ‘die’ more than once (erythroblasts ‘die’ when they lose their nuclei and mitochondria to become erythrocytes, and then ‘die’ again when they are eliminated from circulation; keratinocytes ‘die’ when differentiated and lose their nuclei and mitochondria, and then ‘die’ again during desquamation [...]). These cells remain active and functional after ‘partial death’ (Melino *et al.* 2010: 5).

As a result, the notion of cell death has been revised and redefined on various occasions. The *Nomenclature Committee on Cell Death (NCCD)* has written three reports to unify the definitions and terminology regarding cell death. While the first two devoted a section to the definition of cell death: “When is a cell ‘dead?’” and “Dead cells” (Kroemer *et al.* 2005: 1464) and “When is a cell ‘dead?’” (Kroemer *et al.* 2009: 4), the third report does not include further comments on the notion as it presumably no longer required clarification (Galluzzi *et al.* 2012). The quotation below is a fragment from the second report where the term is defined:

In the absence of a clear, generally accepted view of the ‘point-of-no-return’, the NCCD suggests that a cell should be considered dead when any of the following molecular or morphological criteria is met: (1) the cell has lost the integrity of its plasma membrane, [...] (2) the cell, including its nucleus, has undergone complete fragmentation into discrete bodies [...]; and/or (3) its corpse (or its fragments) have been engulfed by an adjacent cell *in vivo*. Thus, *bona fide* ‘dead cells’ would be different from ‘dying cells’ that have not yet concluded their demise (which can occur through a variety of biochemically distinct pathways) (Kroemer *et al.* 2009: 5).

The consensus among the scientific community on the meaning of a technical term is common in the process of science making. As argued by Semino (2008: 154), “when particular metaphors are adopted within a scientific community, they tend to evolve towards greater and greater clarification of what aspects of the source apply to the target”. As knowledge of the target domain increases, the meaning of technical metaphors relies less and less on correspondences from the source domain, the metaphors gain new and specialised meanings and, in the end, the terms may no longer be perceived as metaphorical by the scientists (Semino 2008: 133). This is arguably the case of what has happened in the representation of the death of cells and what it means for cells to ‘die’.

This section has provided an overview of the different metaphorical expressions which are used for apoptosis and which have played a major role in the development of the field of cell death. In general, it could be said that cells are (a) personified (through the expressions ‘cell death’ and ‘cell suicide’), or (b) portrayed via ‘mechanistic’ metaphors

(with the expression ‘programmed cell death’). As will be shown in the next section, such metaphorical expressions are also exploited in popularisation articles for the elucidation of the process of apoptosis, and some of the ambiguities that arise in specialised genres may be carried over to more popular accounts.

8.3 Apoptosis in the English subcorpus

8.3.1 Quantitative analysis of apoptosis metaphorical expressions

The process of apoptosis is present⁵⁶ in 29 texts (17 from *The Guardian* and 12 from *The Times*) of the 150 texts which constitute the English subcorpus,⁵⁷ and the technical term of ‘apoptosis’ appears explicitly in only 9 texts of this small sample (5 from *The Guardian* and 4 from *The Times*). As will be shown, the metaphors used to explain this concept – whether explicitly mentioned in the text or not – are very similar to those employed in scientific genres. As in the latter, the metaphorical expressions involve the personification of the cells and the exploitation of the source domain of MACHINES. More creative examples are scarce. Table 8.1 shows the quantitative data for the most recurrent metaphorical expressions of apoptosis identified in the two English newspapers and accounts for the number of instances and the number of texts in which these appear. In addition to the metaphorical expressions shown in the table, other isolated linguistic metaphors were identified, including apoptosis as a *weapon*, a *(survival) mechanism*, a *defence* and an *attack*.

Many of the expressions used metaphorically revolve around the notion of suicide (*commit suicide*, *cell suicide*, *kill themselves*, *destroy themselves*, *self-destruct*). As will be argued, although the suicide image is often perceived as less technical and thus more appropriate for popular genres (Hidalgo Downing and Kraljevic Mujic 2009), it may not always serve the purpose of clarifying the process.

⁵⁶ However, apoptosis was the main topic of the article in only two texts.

⁵⁷ This has been determined by the presence of the term apoptosis, or its related metaphors in the English subcorpus. In many texts, cells are said simply to be *killed*. It is very likely that this is achieved by triggering apoptosis, but since the process is not explicitly referred to and no other identifiable apoptosis-related metaphorical expressions were found, these texts have not been included in this analysis.

Table 8.1 Metaphorical expressions for apoptosis in the English subcorpus

Metaphorical expression	<i>The Guardian</i>		<i>The Times</i>		Combined	
	No. texts	No. instances	No. texts	No. instances	Total texts	Total instances
Commit suicide	7	8	4	4	11	12
Cell suicide	0	0	3	4	3	4
Suicide + noun	1	1	1	1	2	2
Cell death	5	7	2	3	7	10
Programmed cell death	2	2	1	1	3	3
Death	3	3	1	1	4	4
Die	4	6	4	5	8	11
Self-destruct (programme)	0	0	3	3	3	3
Kill themselves	2	2	0	0	2	2
Destroy themselves	1	1	0	0	1	1
Total		30		22		52

The suicide metaphor was the only one to be singled out by means of scare quotes (6 of a total of 18 instances). This not only indicates to the reader that the term should not be taken literally, but may also be because the image is somehow shocking:

(1) Tests showed that the treatment triggered a “*suicide*” response known as apoptosis in the cancer cells, causing them to *self-destruct*. (ti58)

Other metaphorical expressions relate to the notion of cell death (*cell death*, *death*, *die*), which is more generic than the concept of suicide. Although cells can be considered living organisms that cease to exist at some point, I have labelled the term as metaphorical because the death of a cell is different from that of other living organisms, whether human, animal or plant. Furthermore, as argued above, in the scientific literature on cell death, the term is regarded as metaphorical, although its metaphoricity is rarely highlighted in any way (Melino *et al.* 2010: 5), and, in fact, no instance of cell death in the English subcorpus was singled out by scare quotes. In addition, it appears that within the scientific community the question of whether a cell is ‘dead’ or not is not as straightforward as it may seem (Kroemer *et al.* 2005: 1464). The following example illustrates how cells undergo a ‘special kind’ of death, different from that of humans:

(2) Normal cells will *die* once they have broken down beyond a certain point. The researchers found, however, that cancer cells recovered once the chemicals were removed. They were killed irreversibly only once their nuclei began to disintegrate, which happens at the very end of cell *death*. (ti61)

The metaphor of *programmed cell death* is not frequent, with only 3 occurrences. This may be because the metaphor is perceived as more technical than the suicide metaphor

and hence less suitable for popularised articles. In fact, this expression never appeared in isolation, but in combination with other linguistic metaphors that helped to clarify the concept. In Majno and Joris's (1995) terms, the *sell-by date* metaphor in (3) emphasises the timing schedule of the programme rather than the means by which it is carried out, which is expressed by *suicide*:

(3) Which genes have normal functions to suppress tumour growth and to look after the *programmed cell death* mechanism which ensures that cells past their *sell-by date* are neatly *persuaded to commit suicide*? (gu10)

In the following, I illustrate how the different expressions are combined to elucidate the process of apoptosis in a detailed account of a fragment from a sample text in the English subcorpus.

8.3.2 Analysis of a sample text

The excerpt below contains the headline and first three paragraphs of the only text (gu34) in the English subcorpus which describes the process of apoptosis in detail.

Sample text 6. Scientists find molecule that tricks cancer cells into dying (gu34)

Scientists find molecule that *tricks* cancer cells into *dying*

Scientists have found a way to *trick* cancer cells into *committing suicide*. The new synthetic compound, which *removes* a molecular *safety catch* that *activates* the natural *executioner* in the body's cells, could lead to better treatments of cancers [...].

The body has several *defences* against cells growing out of control and into tumours – one is to cause defective or dangerous cells to *commit suicide*. This natural process of *cell death*, called apoptosis, involves a protein called procaspase-3. When *activated*, procaspase-3 changes into an enzyme called caspase-3, which begins the *cell death*. In cancers, this *mechanism* is often faulty and cells can grow unchecked. Many types of cancer are *resistant* not only to the body's own signals for *cell death* but also to the chemotherapy drugs that try to mimic it.

But Paul Hergenrother [...], has found a way around the natural biological process that *kickstarts* apoptosis - a synthetic molecule that directly *activates* procaspase-3. "This is the first in what could be a host of organic compounds with the ability to directly *activate executioner* enzymes."

This fragment exploits metaphorical language extensively to explain the scientists' achievement: to prompt the process of apoptosis in cancer cells by means of a synthetic molecule. The text contains a number of personifications⁵⁸ (*trick*, *dying*, *committing*

⁵⁸ Although some of the metaphorical expressions such as *death* and *die* could also apply to animals and plants and, thus, it would be inappropriate to talk about personification. I have classified these terms under this label for the sake of simplicity.

suicide, executioner, cell death) and metaphorical expressions from the MACHINE source domain (*molecular safety catch, activate, mechanism, kickstart*) as well as isolated examples from the WAR, VIOLENCE AND AGGRESSION source domain (*defences, resistant*).

The text opens with a headline that personifies the two agents under discussion: the molecule (procaspase-3) and cancer cells. They are presented in direct interaction and cancer cells are said to be *tricked into dying* by the molecule.

The first sentence of the lead is similar to the headline but instead of *dying*, it states that cancer cells are *tricked into committing suicide*. Both expressions, *trick* cancer cells into *dying* or into *committing suicide* are metaphorical renderings of the process of apoptosis. The perhaps shocking nature of the statements may be justified by the rhetorical function of the loci they occupy in the text. The headline and lead summarise the news report, but also serve to attract the readers' attention. In the next sentence of the lead, the journalist introduces metaphorical expressions from the source domain of MACHINES to explain how the *death* is brought about: the molecule *removes* a molecular *safety catch* and thus *activates* a natural *executioner* in the body's cells. The metaphorical expression molecular *safety catch* could be evoking the image of a firearm or some other machine in general.⁵⁹ However, since in the previous sentence cancer cells were said to *commit suicide*, it makes sense to think of a gun. The natural *executioner* in the body's cells refers, as mentioned later in the article, to caspase-3. The caspases are a family of enzymes which, once activated, start degrading the cells' organelles. There are two types of caspases 'initiator' and 'effector' or 'executioner' caspases (Pelengaris and Khan 2006b: 261). Caspase-3, which belongs to the second type, is personified as are the other relevant agents in the article: the molecule and cancer cells. Since the process takes place within the cell, the motivation for the ambiguous suicide image introduced in the previous sentence is clarified: the cell has the intrinsic components to bring about its own death.

⁵⁹ *The Macmillian Dictionary of English* definition for safety catch includes two entries: 1. The part of a gun that stops you from accidentally firing it. 2. The part of a machine or piece of equipment that prevents it from starting, working, or opening accidentally.

Apoptosis is a fairly specialised notion, probably unfamiliar to the lay audience. Therefore, in the second paragraph, the journalist introduces some basic information about the process which will serve as a background for the readers to understand the rest of the article. The process is portrayed as a bodily *defence* against the formation of tumours and the metaphor of cells *committing suicide* is repeated in the text. This is followed by the introduction of the specialised term ‘apoptosis’, which is defined as ‘a natural process of *cell death*’ immediately before the term is presented. The chain of reactions of one of the pathways leading to cell death is then explained. Finally, the fact that this *mechanism* is defective in cancer cells is also explicitly mentioned.

In the third paragraph, the journalist goes back to the investigation being reported and provides further information about the experiment. The scientists have found another way to *kickstart* apoptosis. This expression, which is drawn from the source domain of MACHINES, is consistent with other linguistic metaphors introduced previously: apoptosis is a *mechanism*, procaspase-3 becomes *activated* and removes a molecular *safety catch*.

This short fragment shows how both personification and the MACHINES source domain are used systematically and in combination to elucidate the process of apoptosis and the scientific discovery made in this field. The three agents – the molecule, cancer cells and caspases – are personified and more complex and specific biological relations are explained by drawing from the source domain of MACHINES.

8.3.3 Problematic examples in the English subcorpus

As mentioned in the previous sample text analysis, the use of the ‘suicide metaphor’ may be justified by the fact that the text explicitly mentions that the molecular machinery to bring about the death of the cell resides within the cell itself: ‘the new synthetic compound, which *removes* a molecular *safety catch* that *activates* a natural *executioner* in the body’s cells’. In addition, the metaphor should be analysed within the rhetorical structure of popularisation articles. Thus, the personification of the molecule which *tricks* cancer cells is justified by the fact that it serves to condense and summarise

the outcome of the research while the shocking suicide image helps to catch the readers' attention.

As shown in the quantitative analysis (table 8.1), metaphorical expressions related to the notion of suicide are recurrent in the corpus. Although it is possible that the suicide metaphor is prevalent because it is a fairly conventional way to explain the process of apoptosis, in the light of the examples analysed here, I argue that the use of this image may not be the most appropriate choice among other available options. My argument is based on two main reasons.

The first problem can be seen in the following excerpts, which have been extracted from two texts that, beyond the inclusion of the suicide metaphor, do not develop the explanation of the process of apoptosis:

(4) "Instead of going on dividing indefinitely, the cells float free and then go into apoptosis – the process of *cell suicide*." Normal cells *commit suicide* at the end of their life cycles. But when this process goes wrong and cells continue dividing unchecked, the result is a tumour. (ti14)

(5) AITC [allyl-isothiocyanate] seems to prevent cancer cells becoming "immortal", the property that makes them different from healthy cells which "*commit suicide*" instead of dividing infinitely. (gu18)

In examples (4-5) healthy cells are expected to *commit suicide* – it is the normal way to go; otherwise, the result is a tumour. In scientific genres, the suicide image has proved useful for theorising about and explaining cell death in spite of the potential ambiguities which may arise from its usage (Ameisen 2002: 368, Melino *et al.* 2010: 5). After all, scientists have sufficient knowledge of the target domain to interpret the metaphor correctly (Semino 2008: 139). In the context of popularisation articles, however, since the motivation of the metaphor is not normally explained (compare sample text 6 above), the reader may be left somewhat puzzled. In my view, if no further details about apoptosis are provided, simply stating that 'normal cells *die*', would be a more transparent way of portraying the process. Take example (6):

(6) The problem with cancer cells is their immortality. While other cells live their allotted span, *die* and are replaced, cancer cells carry on dividing. (gu17)

As readers rely on their knowledge of the source domain to make sense of the target (Semino 2008: 139), the idea that the normal way for healthy cells to *die* is by *committing suicide* may not be easy to decode.

As regards humans, although cultural differences may apply here, suicide is perceived as an unnatural misfortune. The most natural way to *go* is through old age or disease. Analogously, if cells are to be personified, and provided that the article is not going to delve any deeper into the process of apoptosis and justify the motivation of the suicide metaphor, it would probably be less confusing to say that cells *die*. Another possible limitation of the metaphor is that it may be difficult to comprehend why the *suicide* of a normal cell should be beneficial to the organism.

I find the following quote from a scientist, which is one of the rare creative analogies for apoptosis identified in the English press, much more appropriate:

(7) “In this sense, you can think of cancers as the *living dead*: they are made up of cells that should have been killed off but which somehow have not and which pass through the body with deadly consequences”. (gu71)

In (7) the abnormal trait acquired by cancer cells – the evasion of apoptosis – is explained through an image which also emphasises an ‘abnormal’ characteristic in the source domain. Of course, this should be read in the light of mythology and folklore. The metaphor of the *living dead* conjures up the idea of cancer cells as zombies; creatures which should have died but have managed to avoid perishing, thereby lingering in the world of the living (i.e. rest of the body). Nevertheless, it should be noted that, although from an explanatory point of view the image could be said to be more logical and clarifying, it may not be fully adequate since it may be distressing to some readers, especially cancer patients (Sontag 1991).

The second problem arises in those examples where different substances or biological agents are presented in direct physical or verbal interaction with the cancer cells. Take the headline and the lead of the sample text:

(8) Scientists find a molecule that *tricks* cancer cells into *dying*. (gu34)

(9) Scientists have found a way to *trick* cancer cells into *committing suicide*. (gu34)

In the analysis of the sample text, I argued that this use may be justified by its location in the headline and lead and the metaphor might have been expressed in this way to catch the reader's attention. In addition, the ambiguous sentences are clarified in the rest of the article. However, this is not always the case in the other numerous examples identified, where cancer cells are said to be *persuaded*, *made*, *forced*, *told*, or *induced* to *commit suicide* or *self-destruct*, or *jolted* or *coaxed* into doing so:

(10) Programmed cell death mechanism which ensures that cells [...] are neatly *persuaded* to *commit suicide*. (gu10)

(11) Using very short, very powerful electric shocks, researchers are developing a way to *jolt* cancer cells into *committing suicide*. (gu16)

(12) Ginger seems to offer a two-pronged *attack* on cancer cells. It *makes* them *commit suicide*, known as apoptosis. (gu31)

(13) A natural survival mechanism called apoptosis, in which damaged and potentially cancerous cells are *forced* to *commit suicide*. (gu47)

(14) An anti-tumour protein which puts cells into hibernation or *makes* them *commit suicide*. (gu56)

(15) the “zapped” cells send out signals which *tell* their neighbours to *commit suicide*. (ti10)

(16) If cancer is detected, the computer orders the release of a single-strand DNA molecule designed to *induce* cancer cells to *self-destruct*. (ti13)

(17) The chemical [...] has been found to *coax* cancer cells into *committing* a form of *suicide* by preventing them from repairing themselves when they come under *attack*. (ti20)

All of these examples (10-17) reflect the specification of the ‘means’ by which apoptosis is carried out as opposed to the ‘timing’ of the event (Majno and Joris 1995: 11), and they emphasise the intrinsic ‘capacity’ of the cell to induce or repress its self-destruction (Ameisen 2002: 368). Examples (10), (13) and (14) explain how in the normal process this capacity is activated by means of interactions that take place within the organism. In contrast, in (11), (12), (16) and (17), in which apoptosis is restored, the process is initiated from outside by the external stimuli provided by chemical agents, radiation or electroshocks. The ‘collective suicide’ in (15) is an exceptional case in that the cells affected by the external agent (radiotherapy) interact with adjacent cells to reduce or eliminate the tumour without damage to healthy cells.

All the examples involve a causal relation which is represented metaphorically either by a communication verb – explicitly with *persuade*, *tell* and *coax* and implicitly in the case of *induce* – or by a verb expressing coercion or violence as in *force* and *jolt*. The

delexicalised verb *made* in (12) can also be interpreted in the light of violence as it occurs in the context of an *attack*. Thus, only *make* in (14) can be interpreted as a neutral causal relation devoid of any violent associations. As seen in chapter 6, metaphors of violence are common in the discourse of cancer, but metaphors related to language and communication are also frequent in cell biology both in relation to the genetic code (Knudsen 2003) and to express interactions between biological entities (van Rijn-van Tongeren 1997).

However, it could be asked if these personifications are the most appropriate representations of causality when combined with the suicide image to explain and clarify the process of apoptosis. Firstly, a suicide is the voluntary decision adopted by an individual to end his or her life. While some verbs expressing more neutral causal relations might be acceptable (*made, induce*), neither *persuasion* nor *coercion* seem appropriate since a forced suicide could be more reasonably termed a murder, as has also been pointed out in the scientific literature (Spaeth 1998: 9).

Therefore, to say simply that cells are *caused* (or some other neutral verb) to die would be less ambiguous. Take the following example:

(18) “If you switch it [molecular mechanism] on it does two things – it *induces* the cells *to die*”. (gu49)

As shown in example (3), different metaphors (*programmed* and *sell-by date*) may be combined to help clarify the process. The use of alternative metaphors to explain complex phenomena has been said to be important to facilitate comprehension in pedagogical texts (Semino 2011: 151, Cameron 2003: 39). In addition, the use of alternative expressions may be stylistically motivated to avoid repetition. Nevertheless, the combining of different metaphors should always be carefully examined since this does not necessarily elucidate the process under discussion. In (19) apoptosis is explained by the combination of the expressions *cell death* and *suicide*. Since the text does not delve any deeper into the implications of apoptosis, in my view, the perhaps gratuitous inclusion of the suicide metaphor at the end complicates the issue rather than helping to clarify the process:

(19) When the drug is administered to patients, it will affect all cells, but when it is withdrawn healthy cells will continue to grow while cancer cells will go into a process of *cell death*, or “*suicide*” (ti23)

The examples above have shown how metaphorical expressions from most of the texts dealing with apoptosis in the English subcorpus draw on those used in the scientific literature. I have also argued against the automatic use of the suicide metaphor since, in certain contexts, it may add further confusion to the explanation of the already complicated notion of apoptosis.

8.3.4 Creative examples in the English subcorpus

Although apoptosis is presented through fairly conventional metaphors, mostly revolving around the notions of ‘death’ and ‘suicide’ combined with mechanistic images, some texts include more creative expressions to help to clarify different aspects of the process.

As previously mentioned, the likening of cancer cells to the *living dead* in (20) underscores in an original way that apoptosis is a natural process and that its evasion leads cells to an abnormal state:

(20) “In this sense, you can think of cancers as the *living dead*: they are made up of cells that should have been killed off but which somehow have not and which pass through the body with deadly consequences” (gu71)

In a similar vein, in (21), cells are said to have a *sell-by date*, after which they are persuaded to *commit suicide*:

(21) Which genes have normal functions to suppress tumour growth and to look after the *programmed cell death* mechanism which ensures that cells past their *sell-by date* are neatly persuaded to *commit suicide*? (gu10)

This expression implies that cells are perishable and that beyond a certain point they no longer possess their optimal characteristics for their ‘correct’ functioning in the organism. In addition, since products past their *sell-by date* should not be for sale, the expression suggests that cells past their *sell-by date* should not remain in the organism. More crucially, Ameisen (2002) noted the ambiguity of the notion of ‘programmed’ in biology and in the context of cell death in particular because of the determinism implied by the term. In (21), this ambiguity is somehow neutralised. Apoptosis is to some extent

a timed event (*sell-by date*); on the other hand, its actual completion is influenced by other factors within the cell environment.

The same is largely true in (22), where the notion of ‘programme’ is conveyed by portraying cells with an internal *clock* and *timing mechanism* marking their lifespan. Unlike healthy cells, cancer cells manage to subvert this *mechanism*, but the researchers have found a way to *activate* it again.

(22) “We have found evidence of a new *mechanism* for *stopping* the *clock* on a cancer cell’s *timer* and preventing its *life-span* from *ticking down*. It raises the possibility of starting the *clock* again and making cancer cells susceptible to *death* once more.” (gu17)

Other isolated linguistic metaphors are drawn from the WAR, VIOLENCE AND AGGRESSION source domain and include the portrayal of the process as a *weapon*, an *attack* and a *defence* or as a *bodily survival mechanism*:

(23) The chemicals *triggered* signals that caused apoptosis, a form of *programmed cell-death* that is an important *weapon* against cancer. (ti19)

(24) Ginger seems to offer a two-pronged *attack* on cancer cells: it makes them *commit suicide*, known as apoptosis, and self-digest, known as autophagy. It offers the hope that when one form of *attack* starts to fail the other will kick in. (gu31)

(25) The body has several *defences* against cells growing out of control and into tumours – one is to cause defective or dangerous cells to *commit suicide*. (gu34)

(26) They also looked for evidence of a natural *survival mechanism* called apoptosis, in which damaged or potentially cancerous cells are *forced to commit suicide* before they can form tumours. (gu47)

In these examples, less frequent metaphorical expressions in the context of apoptosis appear in combination with the conventional images for this process in specialised and popular genres to shed light on the different ways in which apoptosis is initiated. In (23) and (24) apoptosis is portrayed as a *weapon* and as an *attack* because external agents (chemical compounds) activate this process. In contrast, in (25) and (26) the emphasis is placed on the fact that the process is intrinsic to the organism – a *defence* and a natural *survival mechanism*. In addition, the causal relation that specifies the ‘means’ whereby apoptosis is brought about is expressed by the more neutral *cause* in (25) whereas (26) uses the coercive *force*.

Although it might be fortuitous, an interesting pattern emerges in examples (23) through (26): all four combine the personification of cancer cells, with mechanistic metaphors

and metaphorical expressions from the WAR, VIOLENCE AND AGGRESSION source domain as shown in table 8.2.

Table 8.2 Combination of metaphor systems to represent apoptosis

Example	Personification	Mechanistic	WVA
23	(programmed) cell death	trigger	weapon
24	suicide	kick in	attack
25	suicide	out of control, safety catch removed	defence
26	suicide	survival mechanism	force

In (23) the personification is realised through the term *programmed cell death*, which also includes a mechanistic component. In (25) the expression *out of control* relates to the fact that in cancer cells the *safety catch* is constantly on, thus making them immortal (see sample text 6 in section 8.3.2).

8.4 Apoptosis in the Spanish subcorpus

8.4.1 Quantitative analysis of apoptosis metaphorical expressions

The process of apoptosis is present in 29 texts (14 from *El País* and 15 from *El Mundo*) of the 150 texts which make up the Spanish subcorpus. The technical term ‘apoptosis’ was explicitly mentioned in 15 of the 29 texts dealing with this process (8 from *El País* and 7 from *El Mundo*). The term appears between brackets in 8 texts. In these cases a metaphorical alternative is given first and then the technical name is provided. In only one text was the technical term not explained at all. As in the English press, the metaphors employed to explain this concept are similar to those used in the scientific literature, and creativity in the reporting of this process is rare. Therefore, when dealing with apoptosis, personification and the source domain of MACHINES are also exploited. Table 8.3 provides the quantitative data for the most recurrent metaphorical expressions identified for this process in the two Spanish newspapers and accounts for the number of instances and the texts in which they occur.

Table 8.3 Metaphorical expressions for apoptosis in the Spanish subcorpus

Metaphorical expression	<i>El País</i>		<i>El Mundo</i>		Combined	
	No. texts	No. instances	No. texts	No. instances	Total texts	Total instances
Muerte celular programada	5	5	3	3	8	8
Muerte celular	2	4	3	4	5	8
La muerte de las células	2	2	8	9	10	11
Morir	6	7	6	6	12	13
Suicidio	3	3	3	3	6	6
Suicidarse	3	4	0	0	3	4
Autodestruirse	3	4	0	0	3	4
Total		29		25		54

Although the instances are not numerous, it seems that the two newspapers have different preferences for referring to and explaining apoptosis. Whilst *El País* is more varied with regard to the metaphorical expressions used, *El Mundo* shows a tendency to resort to different phraseological variants containing the noun *muerte* ('death'), and it is less inclined to employ metaphorical expressions related to the concept of *suicidio* ('suicide'). As in the English subcorpus, in the Spanish texts the different metaphorical expressions appear in combination to explain the process of apoptosis.

The suicide metaphor is not too conspicuous in the Spanish subcorpus with 6 instances of *suicidio* ('suicide') and 3 of *suicidarse* ('to commit suicide'). It should also be noted that in *El Mundo* the expression of cells 'committing suicide' is not present, whereas in *El País*, and in the English subcorpus, it is more frequent, as is the concept of *autodestruirse* ('self-destruct'), which is also absent in *El Mundo*. The virtual absence of the 'suicide' metaphor in *El Mundo* may be attributable to the ideological slant of the newspaper, which is conservative and shows a close alignment with the Catholic church. In strongly Catholic circles, suicide, like abortion, is a taboo topic.

8.4.2 Problematic examples in the Spanish subcorpus

In the analysis of the English subcorpus, I argued that metaphorical expressions related to the concept of suicide may be problematic depending on the context in which they are used. Since readers rely on knowledge of the source domain, I maintained that, if insufficient information is provided about the motivation of the metaphor, portraying apoptosis in terms of a suicide may be an ambiguous and shocking image, especially if

it is presented as the way for normal cells to perish. A possible solution to this problem may be to state simply that cells ‘die’.

In the three Spanish texts from *El Mundo* in which the ‘suicide image’ appears, it is singled out by the use of scare quotes and hedges, indicating to the reader that it should not be taken literally. A further important aspect of the use of this metaphorical term is that the cells are not personified or said to commit suicide. In (27) it is a *regression mechanism* mediated by a kind of cellular ‘suicide’, in (28) the metaphor is also ‘mechanicised’ and the cells are said to start a *controlled suicide programme* and in (29) the death of the tumour cell is said to be brought about by a kind of *suicide programme* called apoptosis:

(27) En el segundo de los trabajos [...], el *mecanismo de regresión* observado en los ratones era diferente, y estaba mediado por una especie de ‘suicidio’ celular en el caso de los animales con linfoma. (em26)⁶⁰

(28) De hecho, aclara este especialista, sólo una pequeña proporción de estas células tiene la capacidad de *iniciar* metástasis en otros órganos del cuerpo, y muchas de ellas inician un *programa de suicidio controlado* una vez que alcanzan el torrente sanguíneo. (em37)⁶¹

(29) Finalmente, esta autofagia provoca la *muerte* de la célula tumoral mediante una especie de *suicidio programado* llamado apoptosis. (em61)⁶²

It should also be mentioned that, in contrast to the personification observed in the English texts, the verbs of causation accompanying the suicide image in these examples, whether referring to artificial induction of the process, as in examples (27) and (29) or to normal cell function as in (28), are relatively neutral: *mediar* (‘mediate’), *iniciar* (‘start’) and *provocar* (‘provoke’).⁶³

In *El País*, only one text portrays ‘normal’ cells as *committing suicide*, but they are said to be *driven* artificially to do so:

⁶⁰ In the second of the studies [...], the *regression mechanism* observed in the mice was different, and it was mediated by a kind of cellular ‘suicide’ in the case of the animals with lymphoma.

⁶¹ In fact, clarifies this specialist, only a small proportion of these cells has the ability to start metastasis in other organs in the body, and many of them start a *controlled suicide programme* once they reach the bloodstream.

⁶² Finally, this autophagy causes the *death* of the tumour cell through a kind of *programmed suicide* called apoptosis.

⁶³ In this context, Spanish ‘provocar’ does not carry the same aggressive connotations as its English counterpart.

(30) Hasta ahora, era un hecho contrastado que las células normales a las que se *conduce* de forma artificial a su *suicidio* alcanzan un punto de no retorno tras el cual tienen que *morir*, incluso en el caso de que se detenga la apoptosis artificial. (ep68)⁶⁴

In two examples, damaged or cancer cells are said to commit suicide or to self-destruct (*autodestruirse*), but this is because they are ‘altered’ or ‘have found’ that they have made a mistake:

(31) Hay cambios que permiten a las células seguir multiplicándose, lo cual las hace casi invulnerables, y otros que les permiten seguir viviendo cuando están *alteradas*; por lo general las células *alteradas se suicidan* (ep34)⁶⁵

(32) La molécula inhibidora *engaña* a la célula cancerosa haciéndole creer que se ha adherido a tejido sano, y ésta, cuando *descubre el fallo*, *se autodestruye* (ep51)⁶⁶

Secondly, I have questioned the transparency of the examples where cells were said to be forced to commit suicide. Again, simply to mention that something causes the cells to die could be more logical and comprehensible to the reader. Although this problem is less frequent in the Spanish subcorpus, I have identified a number of examples in *El País* where apoptosis is presented in this fashion:

(33) Una molécula de importancia vital como el P53, conocida como el guardián del genoma, un oncogen supresor cuya misión es controlar los procesos de división y *muerte* celular (capaz de chequear si en el proceso de división se han producido daños irreparables en el ADN de la célula y de *ordenar* en consecuencia su *suicidio* o apoptosis). (ep06)⁶⁷

(34) Un mecanismo por el que se *induce* a la célula no solo a *suicidarse* (la famosa apoptosis en las que se basan muchas de las investigaciones sobre el cáncer), sino a autofagocitarse. (ep73)⁶⁸

(35) El Yondelis actúa sobre cinco nucleótidos del ADN de la célula cancerígena, reclutando unas enzimas que *consiguen* que *se suicide* y, por tanto, deje de dividirse sin control. (ep52)⁶⁹

⁶⁴ Until now, it was a verified fact that normal cells which are artificially *driven* to their *suicide* reach a point of no return after which they have to *die*, even if artificial apoptosis is stopped.

⁶⁵ There are changes that allow cells to continue multiplying, which makes them practically invulnerable, and others that allow them to continue living when they are *altered*; in general, *altered* cells *commit suicide*.

⁶⁶ The inhibitory molecule *tricks* the cancer cell, making it believe that it has bound to healthy tissue, and when the cancer cell *realises* the *mistake*, it *self-destructs*.

⁶⁷ A molecule of vital importance like P53, known as the guardian of the genome, a suppressor oncogene whose mission is to control the processes of cell division and cell *death* (the gene is able to check whether during the process of division irreparable damage has been done to the DNA of the cell and as a result to *order* its *suicide* or apoptosis)

⁶⁸ A mechanism which *induces* the cell not only to *commit suicide* (the famous apoptosis on which many cancer studies are based), but also to go into autophagocytosis.

⁶⁹ Yondelis acts on five nucleotides of the cancer cell’s DNA, recruiting enzymes that *make* it *commit suicide* and, thus, stop dividing without control.

Example (33), is the first sentence of the lead of an article entitled ‘Una molécula para que el cáncer *se suicide*’ (‘A molecule which makes cancer commit suicide’), which is similar to the one in sample text 6 from the English subcorpus. However, in (33), apoptosis is not explained further so, in this particular example, the suicide image does not clarify the process; nonetheless, it probably serves the purpose of capturing the readers’ attention.

In examples (30) through (35), a tendency towards greater personification is evident in the verbs of causation accompanying the suicide image compared to those used in *El Mundo*. Thus, in (32) the inhibiting molecule *engaña* (‘deceives’) the cancer cell, thus bringing about its demise, and in (33) the P53 molecule *ordena* (‘orders’) the suicide of the cell, although this is consistent with the communicative images that are typical of gene function descriptions in scientific genres. The external stimulus represented in examples (30), (34) and (35) – *se conduce* (‘be driven’), *se induce* (‘be induced’) and *consigue* (‘makes’ – literally ‘achieves’), respectively – are also relatively mild compared to the English examples of ‘force’ and ‘jolt’.

Similarly, I have not identified any examples in *El Mundo* involving a ‘forced suicide’ in the contexts in which cell death and programmed cell death appeared:

(36) Dos nuevos trabajos [...] emplean docetaxel, un agente quimioterápico que *favorece la muerte* de las células cancerosas por un mecanismo denominado apoptosis. (em03)⁷⁰

(37) Se refiere a los oncogenes, que han ido demostrando su papel en ciertos tipos de tumores [...], y que en circunstancias normales conviven en equilibrio con los supresores tumorales [...], responsables de todo lo contrario: detectar mutaciones peligrosas, corregirlas y, llegado el caso, *ordenar la muerte* de las células. (em05)⁷¹

(38) Éste [un gen] es un importante elemento de la respuesta antiviral. En concreto, *estimula la muerte* de las células infectadas (apoptosis). (em19)⁷²

(39) Aunque ya se habían descubierto compuestos capaces de *activar la muerte celular* (apoptosis), su poca efectividad hacía sospechar a los científicos que las células del melanoma disponían de algún sistema de protección adicional. “Pensamos que teníamos

⁷⁰ Two new studies [...] use docetaxel, a chemotherapeutic agent which *favours* the *death* of cancerous cells through a mechanism called apoptosis.

⁷¹ It refers to the oncogenes, which have been shown to play their role in certain types of tumours [...], and which in normal circumstances coexist in balance with the tumour suppressor genes [...], which are responsible for the opposite effect: to detect dangerous mutations, to correct them and, if necessary, to *order* the *death* of the cells.

⁷² The latter [a gene] is an important element in antiviral response. In particular, it *stimulates* [i.e. triggers] the *death* of infected cells (apoptosis).

que buscar otros mecanismos alternativos de acción para *provocar la muerte celular*". (em67)⁷³

Instead, different substances *favorecen* ('favour'), *ordenan* ('order'), *estimulan* ('stimulate'), *activan* ('activate') or *provocan* ('provoke') the death of the cells, which, as argued in the previous section, may be less ambiguous as they do not include reference to suicide or to self-destruction.

8.4.3 Creative examples in the Spanish subcorpus

As mentioned, creative examples are scarce in the Spanish subcorpus, and most appeared in *El País*. In the following example, the process is described as a *sistema de garantía* ('quality control system'), which in my view is a felicitous metaphor expressing the notion that apoptosis ensures that defective cells are eliminated:

(40) Los trabajos se centraron en como el THC [delta-9-tetrahidrocannabinol] inducía la *muerte celular programada* (llamada apoptosis). Este proceso, que no funciona con las células cancerígenas, actúa como un *sistema de garantía*⁷⁴ del organismo que impide que se reproduzcan las células con errores. (ep11)⁷⁵

In the same fashion, example (41) describes the process as a *mecanismo de control* ('control mechanism'):

(41) Cuando la célula está sometida a varios tipos de estrés o ve dañado su ADN, estos genes lo detectan y *disparan* el proceso de apoptosis (*suicidio celular programado*) [...]. Cuando estos genes fallan, la célula se queda sin el último *mecanismo de control* que puede evitar la aparición del cáncer. (ep16)⁷⁶

Finally, in example (42), the process is described as a *mecanismo de regresión* ('regression mechanism'):

⁷³ Although compounds capable of *activating cell death* (apoptosis) had already been discovered, their scant effectiveness made scientists suspect that melanoma cells had an additional protective system at their disposal. "We thought that we had to search for other alternative mechanisms of action to *provoke cell death*".

⁷⁴ Emphasis in the original.

⁷⁵ The studies focused on how the THC induced *programmed cell death* (called apoptosis). This process, which does not function with cancer cells acts as the organism's *quality control system* which prevents cells from replicating with errors.

⁷⁶ When the cell is under various kinds of stress or when its DNA is damaged, these genes detect it and *trigger* the process of apoptosis (*programmed cell suicide*) [...]. When these genes fail, the cell is left without the last *control mechanism* which can prevent the development of cancer.

(42) En el segundo de los trabajos, [...], el *mecanismo de regresión* observado en los ratones era diferente, y estaba mediado por una especie de ‘suicidio’ celular en el caso de los animales con linfoma. (em26)⁷⁷

The following two excerpts (43, 44) report a scientific discovery carried out by Spanish researchers. The scientists developed a strategy to activate apoptosis in addition to autophagy, another kind of cell death whereby lysosomes degrade proteins and organelles inside the cell.⁷⁸ In each of the articles, one of the scientists involved in the study is reported in a direct quote to explain the two processes:

(43) “La apoptosis es una destrucción poco a poco. Es como si se cogen unas *tijeras* y se van *cortando las cadenas una a una*. Al autofagocitarse se crean vesículas (técnicamente llamadas endosomas) que van destruyendo los componentes de la célula a toda velocidad”. (ep73)⁷⁹

In (43), the writer illustrates apoptosis as a process in which the DNA chains are progressively shortened as if they were cut with scissors, but explains autophagy in non-metaphorical language. In (44), the quoted scientist does the opposite: she barely elaborates on the process of apoptosis as a slow form of *killing*, but draws on a striking set of images to explain autophagy:

(44) Primero, van matando a la célula anfitriona poco a poco (un proceso de *muerte programada* que se llama apoptosis). Luego, se produce una especie de “autocannibalismo”: la célula cancerígena se autofagocita, indica Soengas. “Es como si en un coche de carreras [la célula tumoral] metiéramos un mecánico y lo activáramos para que fuera metiendo en un saco las partes del motor del coche, hasta dejarlo inservible”, explica la investigadora. (ep71)⁸⁰

Auto-cannibalism is a common metaphorical expression for autophagy, a term which comes from the Greek language and literally means *auto-* ‘self’ and *-phagy* ‘to eat or to

⁷⁷ In the second study, [...], the *regression mechanism* observed in the mice was different, and was mediated by a kind of cellular ‘suicide’ in the case of the animals with lymphoma.

⁷⁸ Endosomes and lysosomes are specialised vesicles within eukaryotic cells (‘true’ cells with a membrane-bounded nucleus). Endosomes are smooth sacs within the cell which sort through the material brought to them and send it to the right place in the cell. Thus, in one pathway, cell receptors are separated from their ligands and returned to the cell surface, the other material being passed on to the lysosomes for further processing. Lysosomes contain digestive enzymes that break down worn-out cellular components or foreign material, such as bacteria, which may enter the cell. Thus, endosomes are a kind of sorting department and distribution centre whereas the lysosomes perform the disintegration or self-destruction of cellular and other material.

⁷⁹ “Apoptosis is a gradual destruction. It’s like taking a pair of *scissors* and *cutting the chains one by one*. In autophagocytosis, vesicles (technically known as endosomes) are formed and destroy the cellular components as fast as possible”.

⁸⁰ First they gradually kill the host cell (a process of *programmed death* called apoptosis). Then a kind of “autocannibalism” occurs: the cancer cell autophagocytoses, explains Soengas. “It’s like placing a mechanic inside a racing car and setting him to put all the parts of the car engine in a sack until it is rendered useless”, explains the researcher.

swallow'. In the direct quote, Soengas uses an elaborate analogy whereby she likens the cell to a racing car with a mechanic inside who gradually dismantles the motor until the vehicle is rendered useless. The analogy set up by the researcher presents the process of autophagy in a manner that can be readily visualised by the readers. During this process, the cell is dismantled from the inside by the caspases, and the outer membrane of the cell is not disrupted; thus, with this type of cell death the extracellular environment is not disturbed (Pelengaris and Khan 2006b: 252).

8.5 Summary

This chapter has dealt with the analysis of the metaphorical expressions used to recontextualise and explain apoptosis in the corpus of press popularisations. In section (8.2) a general definition of the process was provided. Since most of the expressions used in popular accounts of the process originate in specialised domains, it was also relevant to comment on the use of these terms in specialised genres. As noted by experts on apoptosis, the metaphorical nature of these expressions may give rise to potential ambiguities due to their mechanistic (*programmed cell death*) and anthropological (*cell death* and *cell suicide*) associations.

Sections (8.3) and (8.4) presented the empirical results of the analysis. In general terms, in popular accounts of apoptosis, creative images are rare and journalists use metaphors similar to those employed in scientific genres. However, in terms of cross-linguistic variation subtle differences have been found.

The quantitative analysis of the English subcorpus revealed a tendency towards a greater use of the suicide image. This subsection also included a detailed analysis of a sample text which exploited metaphorical language extensively when delving into the explanation of the process of apoptosis, particularly through the combination of personifications and mechanistic metaphors. In this particular text, it was argued that the potentially ambiguous suicide metaphor was justified not only because the motivation for the metaphor was explained, but also because the rhetorical function it performed in the article was to arouse a response in the readers and induce them to continue reading.

However, a detailed analysis of the suicide metaphor in other contexts suggested that this formulation might not be the best choice among the available options. My argument was based on two main reasons. First, a number of texts included the suicide image without clarifying either the motivation of the metaphor or the process of apoptosis. Moreover, suicide was presented as the normal way for cells to die, an aspect which may clash with the readers' general frame of reference. Secondly, a number of examples contained verbs of causation in combination with the suicide image to elucidate the means by which apoptosis took place. It was argued that these verbs, especially those related to the notions of violence and coercion complicated the explanation of the already obscure concept of apoptosis. It was suggested that it might be better to use the more generic metaphor of 'death' and its variants, and when combined with verbs of causation, to resort to verbs expressing more neutral causal relations.

Analysis of the Spanish subcorpus showed that there was a general tendency to use different variants centred on the noun *muerte* (death). The suicide image was less frequent, especially in *El Mundo*, which included only three instances. A possible explanation for this disparity may be found in the ideological slant of the newspaper. Overall, since they relied less on the concept of suicide, the Spanish examples proved less problematic than those in the English subcorpus. Thus, when cells were said to *suicidarse* ('commit suicide'), this was because something had gone 'wrong' with them or they were 'altered'. Moreover, when verbs of causation appeared in combination with the suicide metaphor, they were selected from those expressing a relatively neutral causal relation. Although the study corpus may suffice for an analysis of the use of cancer metaphors in the reporting of scientific advances in the press in general, the compilation and examination of a specific corpus would be required in order to make more consistent claims on the metaphorical representation of apoptosis in popularisations.

Chapter 9

Metaphorical renderings of cancer treatment

9.1 Introduction

The present chapter is devoted to the exploration of metaphors that are used in the presentation of conventional and novel cancer therapies in the corpus. As pointed out in chapter 4, metaphors are generally seen as a useful resource in the recontextualisation of scientific knowledge for the benefit of the lay audience where they are used with a number of roles, the pedagogical function being the most prototypical one. Nevertheless, it has been emphasised throughout this thesis that metaphor should be seen as a multifunctional phenomenon. This chapter is concerned in particular with the promotional use of metaphors in cancer popularisation articles. In celebrating scientific advances, scientists and journalists often draw on metaphorical expressions to convey the achievements in a vivid and evocative manner. However, they can run the risk of being over optimistic, unfairly raising the public's and patients' hopes not only for new cancer treatments but also for potential cures. Section (9.2) briefly introduces some information on cancer therapies as well as presenting the different terms which have been used in relation to personalised medicine. Section (9.3) presents the results of the analysis and has been divided into three subsections according to the semantics of the metaphorical expressions under consideration. Section (9.4) provides an in-depth analysis of a sample text from the corpus and discusses the results in relation to the wider debate concerning the implications of the use of promotional metaphors in science popularisation. The final section (9.5) provides a brief summary of the findings of the study.

9.2 Personalised medicine and metaphor

The knowledge gathered from the Human Genome Project holds out the promise of modifying the management of diseases. This promise has been branded as ‘personalised medicine’, ‘tailored medicine’ and more recently ‘precision medicine’ (Smith 2012). Leaving nomenclature issues aside at this point, the underlying rationale is that treatments will be designed to be compatible with the patient’s genetic material in order to avoid as far as possible any undesirable side effects. The field of research devoted to the development of these treatments is pharmacogenetics or pharmacogenomics.⁸¹

In the context of malignant disease, the ‘personalisation’ of medicine is a much desired goal. Current cancer treatment relies on surgery, chemotherapy and radiotherapy. Both chemotherapy and radiotherapy act in a nonspecific way and harm both cancerous and healthy cells (Spector 2010: 27). But advances towards personalised medicine imply a change in the pharmaceutical business model, which instead of creating a few big blockbuster drugs to be used on a large population, will have to produce many different drugs each of which will be suitable for a small number of people. This also implies a rise in the cost of treatments so that pharmaceutical companies can maintain their level of profit.

The term ‘personalised medicine’ as it is understood today appeared in 1999 (Jørgensen 2009). *The Wall Street Journal* featured an article auguring a new era in the practice of medicine (Langreth and Waldholz 1999). But according to experts, little progress has been made to date (Jørgensen 2009). Hedgecoe (2004: 4) argues that expressions such as ‘personalised medicine’ or ‘tailor-made medicine’ have been favoured in public communication, perhaps by the pharmaceutical industry, because they are not only less obscure than ‘genetics’, but they are also free from the potential negative associations of the term. Other expressions related more directly with the treatments, such as ‘personal pill’, ‘designer drugs’, ‘targeted treatments’, ‘magic bullets’, or ‘smart drugs’ have also been criticised for being potentially misleading as they may generate false expectations

⁸¹ The scientific community cannot seem to agree on the actual meaning of the terms. Many authors do not distinguish between the two and hold them to be synonymous (Zika *et al.* 2006). For the purpose of this study the same will apply. Hedgecoe (2003) provides an interesting analysis and explains that pharmacogenomics is a variation on the term pharmacogenetics. He views the former as a rhetorical device which was favoured to obtain policy makers’ and funders’ support.

and hopes (TA-SWISS supervisory group 2004, Drews 2006, Spector 2010). The TA-SWISS supervisory group is particularly critical and advise their colleges to curb their use of metaphors emphasising the individualising nature of future treatments:

Although there is an element of individualisation in pharmacogenetics to the extent that the type and dosage of the drug is determined on the basis of a patient's genetic profile, this does not take into account important individual elements such as age, weight or diet. It must be emphasised that as far as pharmacogenomics is concerned, with regard to the development of new drugs individualisation is not of paramount importance for industry. That would be tantamount to limiting their own sales opportunities, because the market will be fragmented and its potential reduced as a result. For these reasons it would be absolutely desirable to refrain from using metaphors of individualisation. (TA-SWISS supervisory group 2004: 26)

Some developments have already been made in the field of pharmacogenetics to treat specific types of cancers. For instance, Imantinib (traded as Glivec or Gleevec) is a treatment that has consistently been hailed as a 'magic bullet' for chronic myelogenous leukaemia and gastro-intestinal stromal tumours. However, it does not appear to be the ultimate cure for these conditions. In the experts own words: "Using Paul Ehrlich's weaponry metaphor, the magic bullet stuns but does not cure, leaving behind resistant cancer cells to challenge the host on another occasion" (Li-Wan-Po *et al.* 2010: 369). Content studies carried out on the reporting of trastuzumab (commercialised as Herceptin), a drug used in breast cancer and also presented as a magic bullet, concluded that the portrayal of this therapy in the United Kingdom national newspapers was uncritical and that frames such as 'wonder drug' and 'magic bullet' downplayed and obscured the fact that trastuzumab can, in fact, result in adverse effects such as pulmonary toxicity and infusion reactions (Wilson *et al.* 2008). Although these therapies represent a clear advance in the field of oncology, they appear not to be as magical as originally claimed because they are often associated with adverse effects and, in any case, do not constitute the ultimate cure.

In addition to the potential side effects of these new treatments, access to them by cancer patients is not guaranteed given their elevated cost. In a recent article published in the journal *Blood* (Kantarjian *et al.* 2013), a group of about 120 chronic myeloid leukaemia experts have strongly criticised the spiralling prices of targeted cancer drugs in recent years. Although this situation is particularly critical in places with no universal health coverage, countries with public health services like England or Spain are also

presented with the conundrum of deciding which new cancer treatments they should or can incorporate and who is to benefit from them.

In view of the metaphorical nature in the framing of these new biotechnologies, this chapter examines the metaphors through which oncological treatments are promoted both in the English and Spanish print media. More specifically, it seeks to investigate the ways in which currently available cancer treatments are portrayed as opposed to those still under development.

9.3 Results

The analysis revealed that the metaphorical expressions used to present cancer therapies that could be grouped under three broad source domains that I have labelled WEAPONRY, GARMENTS and FOOD AND COCKTAILS.⁸² The following subsections illustrate how the metaphorical expressions from these three groups are realised in popularisation articles and discuss the implications.

Table 9.1 Representation of conventional and novel therapies in the English and Spanish press

Therapy	Therapy characteristics	Source domain English subcorpus	Source domain Spanish subcorpus
Conventional - Chemotherapy - Radiotherapy - Surgery	Non-selective	WEAPONRY - blunt instrument - bomb - carpet-bombing tactics	WEAPONRY - <i>palizas</i> - <i>bomba</i> - <i>estallar</i> - <i>cañonazos</i>
New Pharmacogenomics	Based on concept of using whole-genome information to predict drug action	WEAPONRY - magic bullet - laser-guided smart weapons - targeted GARMENT - tailored treatment FOOD AND COCKTAILS - cocktail - dolly mixtures	WEAPONRY - <i>bala mágica</i> - <i>sitiar</i> - <i>proyectiles dirigidos</i> GARMENT - <i>de diseño</i> - <i>a medida</i> FOOD AND COCKTAILS - <i>a la carta</i>

⁸² Within the CANCER IS WAR conceptual metaphor, treatments represent the physician's *arsenal* so that WEAPONRY was taken as an appropriate label. In the case of personalised medical practice, treatments can be seen to be elaborated like clothes or food and drink to individual specifications. Thus, GARMENTS and FOOD AND COCKTAILS were selected as labels in these cases.

Table 9.1 summarises the source domains that are attributed to conventional and new therapies and provides a sample of the metaphors that instantiate these domains in the English and Spanish press. As we shall see, these metaphorical expressions depict current or potential cancer treatment in a particular way and, in doing so, they carry a specific evaluation of the therapy under consideration, which in certain cases may be controversial.

9.3.1 WEAPONRY source domain

As mentioned in chapter 6, this group of metaphors can be seen as a subset of the WAR, VIOLENCE AND AGGRESSION source domain, which is pervasive in biomedical discourse in general (Annas 1995) and in the popularisation of cancer in the press in particular (Williams Camus 2009a; 2009b; 2009c). The WEAPONRY source domain is exploited in the press to conceptualise both conventional cancer treatment – surgery, chemotherapy and radiotherapy – and new therapeutic approaches under development. However, there is a difference in the manner in which the WEAPONRY source domain is realised linguistically to account for current and potential new treatments.

WEAPONRY in the English subcorpus

In the English subcorpus, conventional treatments are said to be the old treble *line of attack* or the standard *arsenal* against cancer, and chemotherapy is characterised as a *blunt instrument* (5 instances) in the English press:

(1) Dr White said: “Chemotherapy is a very *blunt instrument*. It makes people sick, and its effects are very inconsistent. Identifying genes that make chemotherapy drugs more potent at lower doses is a first step toward alleviating these effects in patients”. (ti46)

Thus, it is portrayed as a tool lacking precision and causing carnage by the leading scientist of a study investigating ways to make chemotherapy more effective.

Chemotherapy and radiotherapy are also directly set in contrast with novel treatments which are – or will be – more *selective* or *personalised*. A number of metaphors or elaborated analogies are exploited in this case. In the following example, conventional

treatments are presented through a rather violent analogy in a direct quotation from the scientist:

(2) Conventional chemotherapy treatments are cytotoxics – they poison the cancer but can also poison the patient at the same time. By contrast the newer drugs have been designed to attack the pathways, or wiring, of the cancer cells. ‘It’s a bit like the difference between trying to break into a house by throwing a bomb in the front door, which will get you in but will have done some damage, and picking the lock on the side door’ (gu67)

In (2), conventional cancer therapy is equated to *throwing a bomb*, and novel approaches in treatment is presented as *picking the lock*, emphasising the potential precision and efficiency of the latter while highlighting the devastating and random effects of the former.

Novel therapies are also described in terms of the WEAPONRY source domain, but it should be noted that there is a significant difference in the nature of the *weapons* employed, as the following example from the lead of an article illustrates:

(3) Cancer treatment remains broadly reliant on three rather *blunt instruments*. A tumour can be cut out with a scalpel, burnt away with radiation, or poisoned with chemotherapy. All can have brutal side-effects, and their lack of precision makes it hard to predict which is most likely to work.

The great promise of cancer genomics is to replace these *carpet-bombing tactics* with the equivalent of *laser-guided smart weapons*. By identifying the precise genetic mutations that are driving a tumour, it should be possible to *attack* these with *targeted* therapies that are much more effective. (ti74)

Although the contrast established by the metaphorical expressions in (3) may help to explain the potential advantages of treatments under development, it could be argued that the main purpose of this framing is rhetorical: it not only helps to open the article in a dramatic and vivid way to capture the readers’ attention but it also serves to present novel therapies in a positive light. However, since chemotherapy is already associated with high levels of fear and anxiety (Bell 2009: 170), a degree of caution should be exercised with the metaphors employed when popularising research findings as most cancer patients will not have immediate access to the highly selective novel therapies and will have to cope with currently available treatment, which is portrayed so negatively in the media.

Other metaphorical expressions used to convey new ‘personalised’ therapies that draw on the WAR, VIOLENCE AND AGGRESSION source domain are more conventional. A recurrent way to refer to these new approaches in English in the specialised literature is with the term *targeted* therapy, which emphasises the fact that they are aimed specifically at cancer cells. These targeted therapies are also portrayed as *weapons* (17 instances) increasing the *arsenal* (4 instances) against cancer. Note the use of modals in the examples below which make the statements more tentative:

(4) The research could lead to new *weapons* in the *arsenal* of anti-cancer drugs. (gu24)

(5) Common ginger may be the next *weapon* in the *battle* against ovarian cancer, scientists have suggested. (gu31)

The treatments that were presented through the *weapon* metaphorical expression included the use of viruses (3 texts), different compounds in food (3 texts), targeted drugs in general (3 texts), the immune system (3 texts), the process of apoptosis, an abortion drug and Glivec.

The portrayal of the above mentioned treatments through the *weapon* metaphorical expression is perhaps a way of helping the readers visualise how basic scientific discoveries will potentially translate into actual treatments. Although it has been argued before that certain types of *weapons* (*blunt instrument, carpet-bombing*) evaluate the target negatively, in this context the use of the generic term *weapon* has positive connotations by following the logic that in a war scenario, the larger the arsenal, the better. In addition to the evaluative function, most of the texts where the *weapon* metaphorical expression is used show a high density of metaphorical expressions from the WAR, VIOLENCE AND AGGRESSION source domain.

A fairly recurrent metaphorical expression identified in the English data is that of the *magic bullet*. This expression is not new in biomedicine. Paul Ehrlich, a German physician and scientist, coined the equivalent German expression *Zauberkegel* in the early twentieth century to frame his approach towards pathogenic microorganisms. Essentially it refers to a compound that would act in the desired location, eliminating the cause of the disease whilst leaving the rest of the organism unharmed. The notion of medicines as a *projectile weapon* has been traced further back to Thomas Huxley, who

in 1881 envisaged that pharmacology would develop drugs that would treat physiological functions in the desired way (Parascandola 1997: 78):

It will, in short, become possible to introduce into the economy⁸³ a molecular mechanism which, like a very cunningly contrived *torpedo*, shall find its way to some particular group of living elements, and cause an *explosion* among them, leaving the rest untouched (quoted in Parascandola 1997: 78, my emphasis).

In reality, however, no real magic bullet has ever been found since all drugs have side effects to a greater or lesser extent, and patient response to the drug also varies (Aldridge 1998: 27).

The lexical metaphor of *bullet* is fairly frequent in the English corpus (11 instances) and was premodified by adjectives ‘magic’ (9 instances), ‘gold’ and ‘silver’ (1 token each). The *magic bullet* is a metaphor often exploited by the media or by journalists when presenting cancer treatments. Given its undoubted appeal, it has proved useful in attracting the interest of legislators and policy makers (Hellman 2005); however, the underlying implication that a single treatment will be able to deal with cancer is, in the light of current scientific knowledge, implausible. Thus, the image creates false expectations. Of the 8 articles containing the *magic bullet* metaphor, in 2 texts⁸⁴ the scientist explicitly presents the treatment under development as a potential *magic bullet*:

(6) “I would describe this development as the equivalent of ultra-specific *magic bullets*. This could mean that a patient coming in for treatment of bladder cancer would receive an injection of the cloaked antibodies”. (ti49) (gu50)

In another article (gu14) dealing with the development of a therapy based on nanotechnology, the journalist alters the conventional expression of the *magic bullet* and refers to *gold bullet*, which is a topic triggered metaphor (Koller 2003b), motivated by the fact that the molecule used in this nanotherapy is coated with gold.

However, the representation of treatments as if they were (*magic*) *bullets* is often questioned by both scientists and journalists. One scientist said that ‘the reality is that there is never going to be a ‘*magic bullet*’ that cures all cancers’ (gu67). In (ti39) the team of researchers are quoted indirectly to warn that it would be premature to regard the treatment as a *silver bullet* cure. In another article, although the notion of the magic

⁸³ In this context ‘economy’ is used figuratively with the meaning of organisation in the body.

⁸⁴ Both articles cover the same news and both include the same quote from the lead researcher.

bullet is not argued against, the journalist, through an indirect quote from a scientist, warns that ‘they may be too magic for their own good’ (ti03) as the treatments are extremely expensive. Finally, another journalist claimed that, although *magic bullets* tend to make the headlines, the lives of patients can also be improved by minor developments (ti11). Thus, the *magic bullet* framing is a powerful notion that has inspired the process of drug discovery since the beginning of the 20th century. It seems unlikely, however, that such *ammunition* will ever be developed. The examples concerning this metaphorical expression show that, although some scientists still draw on the image when presenting their therapeutic developments to the lay public, other researchers and journalists are more cautious with the use of the phrase when popularising advances in cancer treatment.

WEAPONRY in the Spanish subcorpus

In the Spanish press, conventional treatments are also conveyed through negative metaphorical expressions. For instance, chemotherapy was described by a scientist as giving *palizas* (‘hidings’ or ‘beatings’) to patients receiving treatment:

(7) [Massagué] ha recordado que muchos pacientes se siguen curando “a base de *palizas* de quimioterapia que tendremos que ir aprendiendo a sustituir por otros fármacos más eficientes”. (em63)⁸⁵

In the following examples, from the Spanish subcorpus, the imagery is also rather violent as chemotherapy is said to cause the cancer cells to *estallar* (‘explode’) or to represent *cañonazos* (‘cannon fire’):

(8) Su tratamiento no se basaba en hacer *estallar* las células cancerosas con violenta quimioterapia o radiación (ep34)⁸⁶

(9) Con el conocimiento que se tenía de la célula hasta hace poco solo se podía *atacar* al cáncer a *cañonazos*: tanto la quimioterapia como la radioterapia *matan* las células malignas pero también a las sanas. (ep13)⁸⁷

In one of the articles, the journalist quotes an analogy established by the researcher, who compares normal cells to *coches normales* (‘ordinary cars’) and cancer cells to *coches*

⁸⁵ [Massagué] reminded us that many patients are still being cured “by means of chemotherapeutic *hidings* that we will have to learn how to replace with other more efficient drugs”.

⁸⁶ Their treatment was not based on making cancerous cells *explode* with violent chemotherapy or radiation.

⁸⁷ With the cell knowledge available until recently it was only possible to *attack* cancer with *cannon fire*: both chemotherapy and radiotherapy *kill* not only malignant but also healthy cells.

de carreras más blindados ('armoured racing cars') and explains that conventional treatment is not too specific. Thus, chemotherapy and radiotherapy are described as effective but not as efficient since these therapeutic approaches result in undesirable collateral damage:

(10) a diferencia de los coches normales [las células sanas según el símil de Soengas] los coches de carreras están "más blindados", y es más difícil *destruirlos*. Los tratamientos anticancerígenos habituales (quimioterapia, radioterapia) no son muy específicos "es como tirar una *bomba* al coche: se *destruye* el de carreras, pero también los que están alrededor del aparcamiento". (ep46)⁸⁸

As with the English subcorpus, in the Spanish articles chemotherapy and radiotherapy are also set in contrast with potential personalised treatments by means of metaphorical expressions from the WEAPONRY source domain; these highlight the destructive character of the former while emphasising the precision of the latter. In other words, there is a marked difference in the nature of the weapons associated with conventional and novel therapies, as illustrated in (11):

(11) "En vez de *lanzar una bomba* vamos a *sitiar* la ciudad". Así ha ilustrado este martes la nueva tendencia que se prevé para la *lucha* contra el cáncer Ana Rodríguez Quesada [...] "al contrario de lo que ocurre con la radioterapia tradicional, que actuaba como una *bomba eliminando* las células tumorales pero también otras que estaban en el organismo", evitará la proliferación de los habituales efectos secundarios. [...] ha afirmado Rodríguez Quesada, en defensa de una "terapia personalizada" con "*projectiles dirigidos a la célula tumoral*". (em69)⁸⁹

In this example, a scientist is quoted to explain how the tendency in cancer treatment is foreseen. She mentions a change of strategy – instead of the indiscriminate *launching of bombs*, the cancer will be *besieged*. She argues that therapies will be *personalised* equating them with *targeted projectiles*. It should be noted that the expression *projectiles dirigidos* is related to the notion of *targeted* therapy or treatment. In Spanish, however, the term normally used is 'terapia *dirigida*' or 'tratamiento *dirigido*' which loses its militaristic associations (see chapter 6). By using the term *projectiles* the

⁸⁸ unlike normal cars [healthy cells according to Soengas' simile] racing cars are "armoured", and it is more difficult to *destroy* them. Regular anticancer treatments (chemotherapy, radiotherapy) are not very specific "it is like throwing a *bomb* at the car: the racing car is *destroyed*, but so are those which are around in the car park".

⁸⁹ "Instead of *launching a bomb attack*, we'll *besiege* the city". This is how Ana Rodríguez Quesada illustrated on Tuesday the new trend foreseen in the *fight* against cancer. [...] "in contrast to what happens with conventional radiotherapy, which acted like a *bomb eliminating* not only tumour cells but also other cells in the organism", [the new therapies] will avoid the proliferation of the usual side effects, [...] claims Rodríguez Quesada, who advocates a "personalised therapy" with "*projectiles targeted* at the tumour cell".

researcher is not only being consistent with the militaristic frame that she is using, but she also conveys the future treatments in a more evocative way.

The notion of the *bala mágica* ('magic bullet') in the Spanish subcorpus is infrequent (2 instances). In one of the articles, it is used by the journalist to refer to Glivec, and in the other text, it is the scientist who explains the mechanism of targeted therapies by drawing on this image:

(12) “Si identificamos las alteraciones moleculares responsables de un tumor”, añade, “podemos *atacarlas* con medicamentos especialmente diseñados. Por tanto, esas alteraciones se convierten en dianas y las nuevas terapias son auténticas *balas mágicas* de gran eficacia y prácticamente libres de efectos tóxicos”. (ep44)⁹⁰

Metaphorical expressions drawn from the WAR, VIOLENCE AND AGGRESSION source domain are pervasive in the discourse of cancer reporting in the English and Spanish press. Thus, to present cancer treatment as a *weapon* may help to structure this type of discourse coherently. However, scientists and journalists should be careful not to present in a gratuitous manner currently available cancer therapies through violent and aggressive imagery since this is the type of treatment that patients will most likely receive and in general it can be assumed that the public is aware of the devastating side effects of these treatments. In addition, although the metaphor of the *magic bullet* is a powerful concept driving drug discovery, it is controversial in the context of popularisations, as our examples have shown and as Hellman (2005: 621) has also pointed out: “the risk of over-promise implied in the ‘magic bullet’ concept is great, and the resulting cost for creating such illusions is subsequent public disillusionment with cancer research and treatment”.

9.3.2 GARMENT source domain

In 1999, *The Wall Street Journal* featured an article announcing the new era of personalised medicine. Right at the beginning of the article, the old and new approaches in pharmacology are placed in contrast by means of the sartorial metaphor:

⁹⁰ “If we identify the molecular alterations responsible for a tumour”, he adds, “we can *attack* them with specially designed drugs. Therefore, these alterations become *targets* and the new therapies are authentic *magic bullets* that are highly effective and practically free of toxic effects”.

THE PHARMACEUTICAL industry makes billions of dollars a year selling one-size-fits-all medicines. But now the race is on to come up with tailor-made drugs that will treat people based on their individual genetic makeup (Langreth and Waldholz, 1999: 426; republished in *The Oncologist*).

Metaphorical expressions from the GARMENT source domain tend to refer to potential new therapies. As mentioned above, the aim of these new therapeutic approaches which draw on the knowledge gathered from the Human Genome Project is to provide ‘personalised’ treatment for cancer patients. According to the GARMENT metaphor, doctors are seen as the *tailors* who craftily design the treatment (*garment*) which will *fit* each individual patient.

GARMENT in the English subcorpus

In the English subcorpus metaphors from the GARMENT source domain are frequent, but they are not particularly varied. This source domain is primarily realised through the verbal form to *tailor* which is highly conventional (table 9.2).

Table 9.2 Metaphorical expressions based on the lemma *tailor* in the English subcorpus

	<i>The Guardian</i>	<i>The Times</i>	Total
<i>to tailor</i>	7	11	18
<i>tailor-made</i>	2	1	3
<i>tailor</i>	0	1	1
Total	9	13	22

This kind of therapy is conventionally referred to as *tailored* treatment. As shown in the examples below, it is often combined with expressions from the MOVEMENT FORWARDS source domain (*opening the way*, *first step*) to evaluate the outcomes of a scientific investigation (see chapter 10):

(13) A gene that determines the severity of breast cancer has been discovered, opening the way to *tailored* treatments for the disease. (ti16)

(14) “This significant and strategic project is aimed squarely at providing the first step towards *tailored* cancer therapy”. (ti60)

In most of the examples the sartorial metaphor remains ‘closed’, but in one article the tailoring metaphor is creatively elaborated at the beginning and at the end of the text to achieve particular rhetorical effects. Thus, the metaphorical frame serves not only to

bracket the text but also to mark the distinction between current and future approaches to cancer treatments.

(15) IF CANCER PHYSICIANS were in the *retail clothing business*, they would all hope to be *bespoke tailors*. At the moment, unfortunately, they are all working at the *chain-store end of the market* — which means that the treatment “*suit*” they offer will take little account of the fact that the patient’s particular cancer has the equivalent of *short legs, a large waist and one shoulder higher than the other*. New research suggests that this may soon change. (ti09)

The journalist has drawn on the metaphorical notion of *tailored* treatment and has creatively elaborated it to explain how we stand today in relation to cancer treatment and what may lie in store in the future. At the end of the article, he draws on the metaphor again to conclude:

(16) It is still early days for this research, but in the not too distant future physicians could be *measuring* patients for a treatment that really *fits*. (ti09)

GARMENT in the Spanish subcorpus

In the Spanish subcorpus, metaphors from the GARMENT source domain are less frequent and are only included in four texts (table 9.3).

Table 9.3 Metaphors from the GARMENT source domain in the Spanish subcorpus

		<i>El País</i>	<i>El Mundo</i>	Total
a medida	bespoke	3	4	7
traje	suit	2	1	3
confeccionar	to tailor	1	1	2
sastre	tailor	0	1	1
de diseño	designer	0	1	1
Total		6	8	14

In (17) the journalist employs the metaphor in the headline to an article reporting on a case in which a treatment using the patient’s own immune system to treat cancer had proved successful. At a later point in the text, the author refers back to the image and further develops it to explain the characteristics of the treatment:

(17) Autovacunas *de diseño* para matar al cáncer

[...] Y es que los autores de esta investigación han *confeccionado* el tratamiento como si fueran *sastres* que llevan a cabo un *traje a medida*. Este consiste en infundir cantidades masivas de linfocitos T CD4+, cultivados a partir de una muestra sanguínea propia, programados para reaccionar ante un antígeno tumoral con el fin de atacarlo como si fuera un patógeno similar a una bacteria o un virus. (em46)⁹¹

It should be noted that, although in this particular case the patient had been ‘cured’, the article acknowledges that this therapeutic procedure is complex and extremely expensive.

The GARMENT source domain holds a number of advantages over the representation of cancer treatment as a *weapon*. It is not only a more patient-friendly image as no violence is implied, but it also presents the patient as an active *customer* rather than a *battle field*.⁹² Nevertheless, these therapies are still under development and so the metaphor ought to be used with caution in order to avoid false expectations.

In addition, concern has been raised within the field of bioethics since these so-called tailored treatments, which are often presented as available for everyone, will most likely be aimed at groups with a specific genotype for which a given drug works, as pointed out by Smart and co-workers (2004: 323):

While its proponents initially claimed that ‘personalised’ medicine would replace the current ‘one-size-fits-all’ paradigm of drug development and usage, it now seems more likely that pharmacogenetics will tend to direct drugs toward genetically defined *groups*; if you like, ‘off-the-peg’ prescribing to genotype groups rather than individually ‘bespoke’ medicine (highlighting as in original).

The authors also question whether these treatments will be available for people with lower incomes: “Will expensive tailored medicine be the preserve of the wealthy or educated, while others make do with ‘cast-offs’ and ‘hand-me downs’?” (Smart *et al.* 2004: 333).

⁹¹ *Designer* self-vaccine to kill cancer

[...] The authors of this investigation have *tailored* the treatment as if they were *tailors* making a *bespoke suit*. This entails infusing massive quantities of CD4+ lymphocytes, cultured from one of his own blood samples and programmed to react against a tumour antigen so as to attack it as if it were a pathogen like a bacterium or virus.

⁹² It should be noted, however, that the customer frame can also prove controversial. In Spain, the privatisation of the management of some hospitals has given rise to critical voices condemning the mercantilisation of healthcare (see also Segal 2005: 115-132).

9.3.3 FOOD AND COCKTAILS source domain

The last set of metaphorical expressions is also used to present therapies under development, although it should be noted that this domain is only represented by isolated examples in the corpus. Within the frame of the FOOD AND COCKTAILS metaphor, scientists and doctors stand for the *chefs* or *bartenders* who prepare the *order* (treatment) requested by the *customer* (patient).

(18) “In future, cancer drugs will be *tailor-made* for the patient,” he said. “The doctors will screen the patient, identify the genetic defects that are allowing cancer to develop, and *order up a cocktail* of drugs that pinpoint those defects.” (ti03)

In (18), expressions from two different source domains are combined to emphasise the individualised nature of future treatments. As mentioned in the previous section, *tailor-made* is a fairly conventional expression in English; however, the notion is clarified in the following statement by specifying what it means in a biomedical context. Once the patients’ genetic information is available, the text implies that they will receive a special kind of ‘room service’ as a *cocktail* of drugs will be *ordered up* to deal with the defects identified.

The excerpts below (19 and 20) have been taken from the only two texts in the Spanish subcorpus where metaphorical expressions from this source domain were present.

(19) “Aunque sigamos utilizando la quimioterapia convencional, los nuevos fármacos son los que van a marcar la diferencia. Además, no son excluyentes, unos son el *menú* para todos y otros, el *servicio a la carta*”. (ep08)⁹³

(20) Los expertos avanzan que el cáncer de mama contará con tratamientos *a la carta*

[...] Sevilla ha acogido, entre ayer y hoy, el VI Simposio del Geicam. Más de 400 oncólogos se han reunido para abordar el “tratamiento individualizado” del cáncer de mama. El futuro de los tratamientos se perfila “*a la carta*”, según los genes de cada paciente. “Hasta ahora recibían tratamientos según el tamaño y la extensión del tumor y no de su naturaleza”, dice el doctor Manuel Ruiz Borrego, del Hospital Virgen del Rocío, pero la verdad es que “los fármacos que se aplican no son igual de eficaces en todas las pacientes” (ep46)⁹⁴

⁹³ “Although we continue to use conventional chemotherapy, it is the new drugs that will make the difference. Moreover, the two are not mutually exclusive, the former are the *set menu* for everyone and the latter the *à la carte service*”

⁹⁴ Experts announce that breast cancer will have *à la carte* treatments
[...] Between yesterday and today Seville will host the 6th Geicam Symposium. Over 400 oncologists have met to approach “individualised treatment” of breast cancer. The future of treatments is outlined as *à la carte*, according to each patient’s genes. “Until now they have received treatment according to tumour size and extension and not according to its nature,” says Doctor Manuel Ruiz Borrego, of the Virgen del Rocío Hospital, but the truth is that “the drugs used are not equally effective in all patients”.

The metaphorical expressions in examples (19) and (20) frame future treatments as *à la carte* service to emphasise the personalised nature of these treatments, which will cater for the individual needs of the patient. In (19), the scientist is predicting and sharing his vision of what he believes that future therapy will be like. However, what they could specify more explicitly is how far ahead that future lies and acknowledge that not all patients will have direct access to this *haute cuisine*, since it is likely to be expensive. In addition, the framing of treatments as *food* also hides the possibility of adverse reactions.

Indeed, in another example from the English subcorpus, a scientist questions this kind of ‘soft’ portrayal. Although he acknowledges the potential of experimental cancer medicines, he argues that it is wrong to depict them as if they were innocent confectionary:

(20) ‘It would be wrong to portray experimental cancer medicines as *dolly mixtures* that will cure everyone. They’re not,’... ‘However, they are exciting new treatments, which are targeting the lesions that cause cancer’. (gu67)

Metaphorical expressions from the FOOD AND COCKTAILS source domain can be seen to share the advantages presented by those from the GARMENT source domain in that they are not aggressive and confer a more active role on the patient. Thus, the doctor-patient relation in the choice for the treatment is analogous to the waiter-customer interaction in discussing the order from a menu. There is further room for development within this scenario, for instance by pointing out that the *food* may produce an allergic reaction (side effect) in certain customers. However, the corpus data suggest that journalists and scientists use it to highlight the positive side of the therapies. Thus, the portrayal of cancer treatment as *food* or *cocktails* could be said to be too bland as it obscures the potential secondary effects that the therapies may have.

9.4 Sample analysis and discussion

To illustrate how the metaphors from different domains appear in actual texts, I have chosen an extended fragment from text (ti09), where the journalist explains the potential of personalised cancer treatments that are being developed. The example shows (A) the

headline, (B) the lead, (C) the first two paragraphs of six examples illustrating how the recent advances could help to overcome some of the hurdles in present cancer treatments; (D) an evaluation of the examples presented, and (E) the conclusion.

Sample text 7. Medicine on target: new cancer hopes (ti09)

- (A) Medicine *on target*: new cancer hopes
- (B) IF CANCER PHYSICIANS were in the *retail clothing business*, they would all hope to be *bespoke tailors*. At the moment, unfortunately, they are all working at the *chain-store end of the market* — which means that the treatment “*suit*” they offer will take little account of the fact that the patient’s particular cancer has the equivalent of *short legs, a large waist and one shoulder higher than the other*. New research suggests that this may soon change.
- (C) For instance, one of the biggest challenges facing a cancer physician is knowing whether the tumour is going to spread (metastasize). Most cancer deaths are caused not by the original cancer but by the effects when it *colonises* other parts of the body. Whether the cancer spreads had been thought to be largely a matter of chance, so most cancers are treated equally *aggressively*, just in case.
- (D) However a team at the Dana-Farber Cancer Institute in America recently found the gene *signature* in tumours that seems to predict the probability of metastasizing. This particular gene *signature*, which involves 17 genes, is a pattern that shows up in breast, prostate and some brain tumours. “This strongly supports the idea that some primary tumours are preconfigured to metastasize and that this is detectable at the initial diagnosis,” says Dr Sridhar Ramaswamy, of the institute.
- [4 paragraphs including 2 examples]
- (E) These and other genetic *signatures* — such as one that predicts which children with Wilms’ tumour are more likely to relapse — look like finally fulfilling the longstanding promise of the Human Genome Project to *target* all sorts of medical treatments more accurately. Many patients could avoid treatments that are ineffective and debilitating.
- It is still early days for this research, but in the not too distant future physicians could be *measuring* patients for a treatment that really *fits*.

In addition to metaphorical expressions from the WEAPONRY and GARMENTS source domains, this text also includes instances of the INVASION AND COLONISATION; WAR, VIOLENCE AND AGGRESSION; and TEXT source domains. However, these metaphors perform different functions in the discourse.

As we have seen in the preceding sections, new therapies are characterised by their precision and here the author draws the reader’s attention by alluding to this now familiar conceptualisation within the WEAPONRY domain (*Medicine on target*) in the title (A). Of greater interest, however, is the tailoring theme, which appears in both the lead (B) and conclusion (E). The journalist creatively elaborates the sartorial motif in an explanation of the long-term goal of cancer research (*bespoke tailoring*), but at the same time conveys a realistic picture of where this type of research stands today (*chain-store*

end of the market). This motif provides a circular framework for the text and brings the topic closer to the audience.

In the body of the text (C), the author addresses some of the difficulties facing cancer researchers and physicians. Metastasis, a major problem, is conceptualised through the conventional metaphor of *colonisation* and the response to this, which forms part of the cancer is war imagery, is *aggressive* treatment. In addition, the promising new research is based on the discovery of a pattern of genetic mutations that could lead to more precise treatment by differentiating patients whose disease is susceptible to therapy from those who would not respond. This discovery is portrayed through the GENOME IS A TEXT metaphor, but the particular instance ‘gene *signature*’ is considered so conventional that the journalist does not even define it.

The examples in the four paragraphs not shown in the sample text also explicitly or implicitly exploit these same three metaphorical expressions (*colonisation*, *aggression* and *signature*) before the author brings all four paragraphs together in his evaluation (D). This also provides the connection between the *signature* motif and *target* image from the title (A). In his conclusion (E), the journalist returns to the *bespoke tailoring* frame but points out that this customised treatment (*measuring* patients for a treatment that really *fits*) is still some way off.

From this analysis it is clear that the journalist is using the various domains in different ways. While he draws on the three conventional ‘closed’ metaphors taken from expert genres, his creative and vivid use of the GARMENT scenario in the lead serves both a pedagogical purpose and to attract the reader’s attention. By picking this metaphor up in the concluding statement, the author not only establishes the link with the precision of the selective targeted approach, but persuasively underlines the added value of the more recent shift towards individualised treatment for cancer patients.

Both journalists and scientists draw on metaphors in order to communicate with, and bring science closer to, the general public. However, metaphors are not only used for explanatory purposes. In the case of journalists, they also resort to them to make their article newsworthy for the newspaper editors. In the case of scientists, they also exploit

metaphors to justify their research and to attract funding. In this way, the metaphorical expressions chosen may be too optimistic and hyped up.

Wilson *et al.* (2008), in their study of the coverage of trastuzumab (Herceptin) in the UK national newspapers, question whether we are:

witnessing patient pester power or quasi direct-to-consumer advertising, where awareness is raised about new products and patients, charities and indeed clinicians then demand that these products be made available? If this is the case we need to know more about who is driving this particular type of marketing, its actual impact on clinician and consumer behaviours and whether it is permitted within the existing regulatory code of practice (Wilson *et al.* 2008: 131).

Since the metaphors discussed may create unrealistic expectations, which, as evidenced in those examples where the metaphors are contested, science is still not able to meet, there is a continuing need for writers to strike an adequate balance between the use of metaphor to recontextualise science in an accessible way for the reader, and avoiding the creation of hype.

Drews (2006: 639) suggests that Paul Ehrlich might have borrowed the notion of ‘magic bullets’ from *Der Frischutz*, a romantic opera which became popular in the nineteenth century. In this opera a young man sells his soul to the devil for a number of magic bullets which allow him to win the hand and heart of his beloved. In the end, the young man not only conquers the lady’s heart but also regains his soul. It would be good if the search for and presentation of a ‘magic bullet’ for cancer were done by soulful scientists and journalists who take into consideration the expectations and disillusionments that are at stake in the presentation of cancer therapies to the public.

9.5 Summary

This chapter contributes to the growing body of knowledge on the use of metaphor in the popularisation of science. In particular, it illustrates the different source domains – WEAPONRY, GARMENTS and FOOD AND COCKTAILS – that are used for the presentation of cancer therapies in the English and Spanish press, with no major differences found between these languages in the corpus studied. A distinction has been drawn between the metaphorical expressions employed to represent conventional cancer therapies and

the so-called ‘personalised’ treatments that are being developed. Metaphorical expressions from the WEAPONRY source domain were identified for both conventional and personalised treatment. But whereas the former is conveyed by means of violent imagery, the latter is explained through highly specific types of weapons. The metaphor of the *magic bullet* has been shown to be controversial since journalists and scientists question the accuracy of this representation. The same is largely true of the metaphorical expressions from the GARMENTS and FOOD AND COCKTAILS source domains. Although the examples from these two systems share the advantage of being more patient-friendly, they have also been questioned for being misleading or unrealistic in their portrayal of personalised treatments.

Chapter 10

The MOVEMENT FORWARDS source domain

10.1 Introduction

The last of the empirical chapters is devoted to the discussion of the metaphorical expressions identified in the corpus which can be grouped under the MOVEMENT FORWARDS source domain. The aim is to explore the different linguistic metaphors realising this source domain together with their patterning and roles in popularisation articles. As anticipated in some examples commented on in earlier chapters, metaphorical expressions from this system often convey the importance of the scientific achievements reported in the articles in the corpus. This chapter draws on Fahnestock's (1986) insights from classical rhetoric to account for the laudatory effect of MOVEMENT FORWARDS metaphors in the context of popularisation articles. The chapter is structured as follows. Section (10.2) provides a general introduction to the use of the MOVEMENT FORWARDS source domain in science reporting and relates Fahnestock's rhetorical account of scientific accommodation to the analysis of the MOVEMENT FORWARDS metaphorical expressions. For the pair of languages analysed here, I present a brief quantitative analysis of the metaphorical expressions identified, followed by a qualitative analysis in which the examples of the MOVEMENT FORWARDS source domain are contextualised. The latter analysis discusses how they are used, the actors to whom the expressions are attributed, and their role within the rhetorical structure and overall goals of popularisation articles.

10.2 Scientific activity and movement

The MOVEMENT FORWARDS source domain could be seen as a subcategory of ACTIVITY or PROCESS IS MOVEMENT FORWARDS and DEVELOPING or SUCCEEDING IS MOVEMENT FORWARDS which, in turn, are lower level metaphors of the basic metaphorical theme CHANGE IS MOVEMENT (Goatly 2007: 51-52).

Metaphorical expressions from the MOVEMENT FORWARDS source domain are frequently used to account for scientific activity and have been commented on by other researchers under the slightly more specific label of JOURNEY (Jäkel 1996, Hellsten 2002:1-3; 133-135, Nerlich 2005b: 79, Ritchie 2008). For the purpose of this chapter, I will use the more generic notion of MOVEMENT FORWARDS because not all of the examples analysed in the corpus necessarily evoke a JOURNEY scenario. Nonetheless, it should be noted that the observations derived from studies that have looked at linguistic metaphors from the JOURNEY source domain in the context of scientific communication could largely apply to my data.

Nerlich (2005b) notes that metaphorical expressions from the JOURNEY source domain are pervasive in scientific communication to popularise scientific discoveries and developments and this often helps to ‘sell’ or promote these achievements to the public. In addition, she has shown how the JOURNEY source domain can be further specified according to the type of journey. In this way, science can be seen as A VOYAGE OF DISCOVERY, AN EXPEDITION, A QUEST, A CONTEST, or A CRUSADE (Nerlich 2005b: 79).

Studies examining metaphorical expressions from the MOVEMENT FORWARDS or JOURNEY source domains in popular accounts of science have noted that these expressions often involve an evaluation of the scientific story being reported (Hellsten 2000; 2002, Nerlich 2005b, Holmgreen 2008, Holmgreen and Vestergaard 2009).

Nerlich (2005b) explains that the use of JOURNEY metaphors in science involves a SOURCE-PATH-GOAL image schema that is grounded on experience. Apart from being experientially grounded, the metaphor could also be culturally motivated. In the author’s own words:

As the experience of journeying typically involves a forward motion, the gaining of new knowledge during a metaphorical journey of discovery is in general regarded as 'progress' or an 'advance' (and as worth the effort), which means that the journey metaphor is given a positive perspective and the aim or endpoint of the journey is regarded as 'good'. These positive connotations of the conceptual metaphor SCIENCE IS A JOURNEY are themselves not only rooted in our bodily experience of journeying, but also in a progressive view of science which emerged in the 19th century at the height of the industrial revolution; that is to say, they are not only experientially, but also historically or culturally grounded (Nerlich 2005b: 80).

Thus, although JOURNEY metaphors can also convey a negative assessment of scientific achievements (Hellsten 2000), conventional expressions related to MOVEMENT, such as 'move', 'step' and 'advance', tend to act as inconspicuous markers of positive evaluation of the target domain. Within this frame of reference, the longer the distance travelled, the more significant the scientific achievement.

In the analysis of metaphorical expressions from the MOVEMENT FORWARDS source domain, Fahnestock's (1986) account of the rhetorical shift that takes place in the accommodation of science for the wider audience is useful. Drawing on Aristotle's division of oratory – forensic, deliberative, and epideictic – Fahnestock (1986) presents the case for classifying original scientific reports as forensic and deliberative. She argues that their discourse is forensic since the main goal is to validate observations related to ongoing debates and *lacunae* in a given scientific field, as manifested in the methods and results sections. On the other hand, the discourse is also deliberative as the authors also have to justify their current and future research, as in the introduction and discussion sections. In contrast to the classical research article, popularisations are primarily epideictic, their main purpose being to celebrate science. Crucially, the value of scientific discoveries must be made explicit, since journalists cannot rely on the capacity of their audience to recognise the full significance of a scientific achievement. Fahnestock observes that in the epideictic discourse of popularisations, science accommodators make two basic appeals to their audience: namely, the deontological and the teleological, which she defines as follows:

A deontological argument attempts to praise or excoriate something *by attaching it to a category that has a recognized value for an audience*. In science popularisations, all references to breakthroughs and accomplishments of the scientists themselves are basically deontological appeals. A teleological argument claims that something has value because *it leads to further benefits* (Fahnestock 1986: 334, my emphasis).

In the present chapter, I argue that metaphorical expressions from the MOVEMENT FORWARDS source domain play a role in realising both types of epideictic appeals and generally present a narrow view of science. In this narrow approach to scientific activity, the emphasis is placed on a single event that is evaluated in the present (deontological appeal) and projected to a point in the future (teleological appeal).

However, in popularisation articles, metaphorical expressions from the MOVEMENT FORWARDS source domain are also used to cover the middle ground, i.e. what lies between the present event and its future application. By accounting for this middle ground, journalists, scientists and other experts provide a more informative appraisal of the state of the art on the progress of cancer knowledge by adopting the broad view of science.

10.3 Analysis of the English subcorpus

10.3.1 Quantitative analysis of the English subcorpus

A total of 104 texts (69.3%) of the texts in the subcorpus contained at least one metaphorical expression from the MOVEMENT FORWARDS source domain. Nevertheless, although this source domain may be exploited in other genres such as political speeches to provide internal coherence to the texts among other functions (Chilton and Schäffner 2002: 29, Semino 2008: 106-117), in my data, it is used more sporadically in the articles, where the metaphors mostly contribute to the deontological and teleological appeals of popularisation discourse.

Table 10.1 summarises the metaphorical expressions identified under the MOVEMENT FORWARDS source domain.⁹⁵ The metaphorical expressions from the MOVEMENT FORWARDS source domain are numerous and varied in the subcorpus. It should be noted, however, that *lead*, *step*, *breakthrough*, *way* and *advance* (noun) are the most recurrent and conventional metaphorical expressions used to convey scientific outcomes. The remaining linguistic metaphors occur more sporadically in the texts.

⁹⁵ In table 10.1, *advance* (verb) has been shown separately from *advance* (noun) because, as will be seen, they perform different functions. In addition, some phraseological items centred on *way* with the verbs *pave*, *open* and *point* are also shown separately from other expressions involving *way*.

Table 10.1 MOVEMENT FORWARDS metaphors in the English subcorpus

	<i>The Guardian</i>	<i>The Times</i>	Total		<i>The Guardian</i>	<i>The Times</i>	Total
Lead (v)	31	18	49	Headway	1	1	2
Step	19	17	36	Milestone	1	1	2
Breakthrough	15	14	29	Move (n)	1	1	2
Way	10	12	22	Pace	0	2	2
Advance (n)	10	10	20	Path	1	1	2
Close/ Closer	7	2	9	Road	1	1	2
Pave the way	4	3	7	Travel	1	1	2
Pioneer	1	5	6	Change tack	1	0	1
Route	0	6	6	Destination	1	0	1
Advance (v)	1	4	5	Head start	1	0	1
Landmark	4	1	5	Map	0	1	1
Move (v)	1	4	5	Point the way	0	1	1
Open the way	2	3	5	Starting point	0	1	1
Hurdle	2	1	3	Stumble upon	1	0	1
Opens door	1	2	3	Setback	1	0	1
Open avenues	2	1	3	Stumbling block	0	1	1
Direction	2	0	2	Close in on	1	0	1
Frontier	0	2	2				

10.3.2 Qualitative analysis of the English subcorpus

In the popularisation of scientific research and developments, journalists need to convey to the public how or why a particular discovery is relevant or worthy of mention. This is mostly done via metaphorical expressions from the MOVEMENT FORWARDS source domain.

To the lay reader, the identification of a gene or molecule involved in the formation of cancer may be meaningless, or they may not be able to assign appropriate significance to the scientific achievement. Journalists and scientists exploit the MOVEMENT FORWARDS source domain not only to explain the implications, but also to evaluate the scientific activity positively.⁹⁶

⁹⁶ In other discourses, metaphorical expressions from this source domain can also be used to negatively evaluate the target domain. As will be seen, however, this is rarely the case in my corpus. See Holmgreen (2008) for the use of expressions of MOVEMENT for negative evaluation of scientific outcomes.

In the following, I will exemplify how the MOVEMENT FORWARDS source domain is used not only to explain the importance of what has been discovered or developed but also to underline its newsworthiness and cast a positive light on the scientific achievement, taking into consideration the type of appeal the metaphorical expressions help to realise. Attention will also be drawn to other functions and uses of the metaphorical expressions and to which agents they can be attributed: namely, the journalist, scientists or other external experts.

Deontological appeal

In the English subcorpus, the deontological appeal was realised primarily through such metaphorical expressions as *step*, *breakthrough*, *advance*, *landmark*, *milestone*, *move*, *headway*, *starting point*, *hurdle*, *stumbling blocks* and *setback*. These will be dealt with from this viewpoint although, obviously, in the discourse, the deontological will often appear with the teleological or other functions, which will be discussed together.

Step. The metaphorical expression *step* was recurrent in the English subcorpus with 36 instances. *Step* was premodified by ‘next’ on 11 occasions, nine of which indicated the subsequent stage or stages of the research:

(1) Djamgoz’s team is also conducting a retrospective study of breast tissue biopsies. They hope to pin down the connection between “twitchy” proteins and cancer progression. Clinical trials are the next *step*, and Djamgoz expects success. (ti27)

Thus, the study or investigation reported in (1) was also implicitly labelled as a *step*. However, in the other two instances it was the newly reported research that was designated by an expert as ‘the next *step*’ probably as a measure of precaution since application of the treatment was not yet available:

(2) Stephen Simpson, senior editor of *Science*, which published the results yesterday, said: “This work marks an important next *step* in harnessing the power of our immune systems to fight cancer.” (ti39)

Of the remaining 25 instances when *step* was used explicitly to describe the research outcome, the assessment as such was made through direct and indirect quotations from scientists and experts on 18 occasions. This suggests that journalists may be less inclined to qualify scientific investigations with this metaphorical expression. In these 25 contexts, *step* was usually graded according to the significance of the discovery or

research project as: ‘a major’ (6), ‘the first’ (4), ‘an important’ (4), ‘a big’ (2), ‘a significant’ (2), ‘an exciting’ (1), ‘a giant’ (1) and, paradoxically, ‘a very, very small’ (1) *step* forwards. In 3 instances *step* was followed by ‘closer’ (twice) and ‘further’ (once), thus conveying the idea of continuous progress and in only one context was *step* not modified by any other expression.

As an illustration of this pattern, in six texts the scientists who led, or were engaged in, the investigation being reported presented their findings as a *step*, three of which were modified by ‘first’ (example 3), another two as a ‘major’ *step* forward (example 4), and one as an ‘important’ *step* (example 5):

(3) Michael White, [...], who led the research, said: “Chemotherapy is a very blunt instrument ... Identifying genes that make drugs more potent at lower doses is a first *step*.” “There’s nothing here immediately useful to those individuals with cancer. We’re still at the beginning, but this sort of approach is very effective. It shortens the discovery process, which makes the development process so much quicker”. (gu42)

(4) Dr de Bono said he hoped that the new drug could be licensed and available for treatment of advanced disease within three years. He suggested that it could eventually make chemotherapy obsolete. “This is potentially a major *step* forward,” he said. “These men have very aggressive prostate cancer, which is exceptionally difficult to treat and almost always fatal. We hope that abiraterone will eventually offer them real hope of an effective way of managing their condition”. (ti56)

(5) “If we can identify such molecules we will be approaching a situation where we could influence their activity and hence either encourage or prevent it,” Professor Alberti said. “This could be an important *step* towards stopping cancer in its tracks. “It is still early days, but we are very excited about the prospects for therapy which we can see arising from this discovery”. (ti48)

In all three examples, it is striking that the evident promotion of the research is attenuated by multiple expressions of extreme caution: ‘nothing immediately useful’, ‘still at the beginning’; ‘potentially’, ‘hope ... will eventually offer’; ‘could be’, ‘still early days’. It can be argued that these attenuations are intended to protect the scientists in the manner of ‘shields’ (Prince *et al.* 1982) by reducing the potential damage for making categorical statements (Hyland 1998: 171).⁹⁷ In the context of popularisations, such ‘shields’ would not affect the current value of the new discovery but would limit the scientists’ commitment to the significance of its future development.

⁹⁷ Prince *et al.* (1982) classify hedges into *shields* and *approximators*: with the former, the writer is ‘hedged’ in that his or her commitment to the proposition is attenuated, whereas with the latter the proposition itself is affected. Hyland (1998) includes shields in his category of writer-oriented hedges.

Although journalists made less use of *step*, when they did resort to this metaphor they tended to place it in a prominent position in the text. In one article, the *step* was graded in a headline that read ‘A very, very small *step* to beating the Big C’ (ti13). The *step* was said to be small because the article was dealing with the application of nanotechnology to cancer treatment. The headline exploits the metaphorical expression of *step* rhetorically and persuasively in the form of a pun. Qualifying the scientific development as a ‘very, very small *step*’ breaks with the reader’s expectations because if the *step* was so minor, it would not be newsworthy. In the body of the article, the research reported is, in fact, classed as a *breakthrough*. Thus, the headline is justified by the content of the article. It could, therefore, be said that the metaphorical expression is a topic-triggered metaphor (Koller 2003b). Furthermore, the ‘very, very small *step*’ is placed in contrast with ‘the Big C’, a euphemistic way of referring to cancer.

In another headline, the journalist states that ‘Cancer care takes a giant *step* forward’ (ti72). The article reports on the mapping of the genetic code of two cancers, which is designated by experts as a *milestone* and a *landmark* (see examples 27 and 28). In addition, in the leads of another two articles, the journalist says that scientists are a *step closer* to making a *breakthrough* or a development, thus relativising the importance of the current discovery:

(6) SCIENTISTS are one *step closer* to a *breakthrough* in the fight against cancer after discovering the molecule that allows the disease to spread. (ti02)

(7) Scientists are a *step closer* to developing a Star Trek-style scanner which can pick up signs of disease and give a diagnosis with no more than a wave over the body. (gu43)

The related metaphorical expression of *move* only appears twice in the English subcorpus, but these occurrences share the functions described for *step* above: i.e., to introduce the next stage of the research (8) or to qualify the research itself (9):

(8) The next *move* by the researchers is to test their detection technique more widely. (ti01)

(9) Scientists say *move* is ‘exciting’ (gu40)

Using corpus analysis techniques, Deignan (2010) explored the evaluative qualities of the metaphorical use of *turning point* in a section of the Bank of English corpus. In her data, *turning point* referred to “a point where a situation changes from bad to better, or from one of inactivity and lack of progress to positive progress” (Deignan 2010: 368).

While the expression appears to denote positive evaluation, the author argued that this could not be explained by the mapping of source domain connotations. Literal turning points need not lead to a better place. In a similar vein, a literal ‘step forward’ could result in a sprained ankle or a serious fall. Nevertheless, as mentioned above, a possible explanation for the positive slant of this and other metaphorical expressions related to the JOURNEY source domain, particularly in science communication, could be historically or culturally grounded:

Science’s assumed telos: to overcome boundaries, reach new frontiers, conquer the unknown and make ‘breakthroughs’ on its journey of discovery for the benefit of mankind – a view that itself has been with us since the enlightenment and the conquest of ‘new worlds’ (Nerlich 2005b: 80).

Breakthrough. The *breakthrough* motif is strongly linked to scientific and technological developments but its use in this context is fairly recent. Brown (2000: 89) considers that it is probably the “most powerfully future oriented metaphor within the current disclosure repertoire of science and science journalism”.⁹⁸ The indiscriminate use of this metaphorical expression in the media has been associated with the creation of hype and unrealistic expectations. Nevertheless, in news reporting, journalists need to make their articles newsworthy so that editors select their story among other competing alternatives, and they also need to make their stories attractive for the reading public. Deontologically, *breakthrough*, therefore, is an extremely tempting image to exploit in spicing up a scientific story.

Breakthrough appears 29 times in 24 texts in the English subcorpus. Although it is the third most recurrent metaphorical expression from the MOVEMENT FORWARDS source domain, a detailed analysis of the concordances revealed that it is not always used to characterise the scientific discovery that motivated the article. In three instances the expression refers to past discoveries (example 10) and on three occasions, to scientific or medical discoveries in general (example 11):

⁹⁸ Nerlich (2009) traces its evolution: “The term ‘breakthrough’ first established itself in military usage during the First World War, where it meant ‘an advance penetrating a defensive line’. It was only applied to science and technology in 1958, when, in connection with the H-bomb, it took on its current meaning of ‘a significant advance in knowledge, achievement, etc.; a development or discovery that removes an obstacle to progress.’ The *Oxford English Dictionary* cites the 11 September 1958 edition of the *Listener*, which hailed ‘the technological break-through which allowed both the United States and the U.S.S.R. to produce H-bombs within a year of each other’ (*Oxford English Dictionary*, online) (Nerlich 2009: 204).

(10) In 1979 Cancer Research UK support for Professor Sir David Lane *led* to the *breakthrough* discovery that one gene, p53, is altered or inactivated in the majority of cases of cancer. (ti45)

(11) The findings, and other *breakthroughs* in cancer drug discovery, will be presented at an international conference in Dublin this week. (ti23)

In two articles, perhaps because they are aware of the expectations this expression can arouse, the reporters attempt to explain the difficulties faced by scientists in claiming a *breakthrough* in the context of cancer research (example 12), or they clarify what the term actually means for scientists working in basic research and for doctors and nurses dealing with patients in clinical practice (example 13):

(12) No two cancers are quite the same and even when effective drugs are developed, tumours have a remarkable ability to develop resistance to them. That is why so many “*breakthroughs*” in cancer treatment have failed to make a serious dent, and why scientists have grown wary of claiming them. (ti38)

(13) There is a world of difference between a research *breakthrough* in the laboratory and one that works in the ward. (ti44)

This distinction is made in three texts reporting significant findings in basic research, but two journalists and a scientist explain that the real *breakthrough* will only come when practical applications can be developed:

(14) While this one treatment may make a difference for around a quarter of skin cancer patients, the real *breakthrough* will be extending it to more stealthy tumours. (gu65)

(15) Professor Christian Ottensmeier and his colleagues are trying to develop vaccines for particular cancers, such as prostate cancer – a huge *breakthrough*, if it happens. (gu67)

(16) “The dream scenario is that a combination of the existing chemotherapy drugs and this type of antibody will be a big *breakthrough* and *open up a new avenue* for the treatment of ovarian cancer.” (gu70)

The remaining 18 occurrences of the expression qualify the research being reported. In most cases the expression is employed by the journalists and only very rarely by a scientist involved in the research (once) or a cancer expert (once). This is consistent with Nerlich’s (2009) observations on use of the metaphor in her analysis.

However, some journalists appear to use this expression with a degree of caution. In two texts, for instance, the lead contains the *breakthrough* metaphor, but the achievement is not actually described as such. It is said that scientists may be *closer* to one (see example 6) or that an organism ‘could prove a *breakthrough*’, toning down the force of the metaphor:

(17) A TINY organism first found on the roots of mangrove trees off the Caribbean coast could prove a *breakthrough* in the war against cancer. (ti20)

The journalist may have chosen *breakthrough* as a means of attracting the readers' attention while being careful not to overstate the outcome of the investigation.

The following pairs of examples illustrate how the journalists describe the scientific achievement or discovery as a *breakthrough* whereas the lead researchers quoted resort to other MOVEMENT FORWARDS metaphors and adopt a less triumphant tone. In (18)-(19), the outcome is classed as a *breakthrough* in the headline, but the leader of the research team employs expressions that emphasise the process of journeying and the need to make modest advances to reach the final destination:

(18) Gene project yields skin cancer *breakthrough* [headline] (gu07)

(19) "Travelling through the human genome sequence is going to reveal new secrets of human disease and human biology, but the effect of the sequence is subtler than that," Prof Stratton said. "Because it is so enormous, it has stretched all of us, stretched our minds, our robots, our computers. It's making us look up to do enormous projects, *taking our eyes* to the *horizon*...but to *get* to the *horizon* you have to *go down your garden path* first, and that's what we have done here". (gu07)

In a similar vein, in (20)-(21) the journalist uses the term *breakthrough* whereas the scientist draws on other metaphorical expressions from the MOVEMENT FORWARDS source domain to clarify that although the goal is still far away, they have made some modest progress and that the research process is speeding up:

(20) The *breakthrough*, at the Weizmann Institute in Israel, offers the strongest indication yet that it will eventually be possible to build tiny medical "nanosubs" that hunt down tumours and germs before delivering their drugs. (ti13)

(21) Professor Shapiro said that the technology would have to be refined considerably before it could be tested in animal models, let alone human beings. Nevertheless, the research "represents the first proof of concept and the first demonstration of a possible real-life application for this kind of computer". He said: "It is clear that the *road* to realising our *vision* is a *long* one. It may take decades before such a system operating inside the human body becomes a reality. Nevertheless, only two years ago we predicted that it would take another ten years *to reach the point we have reached today*." (ti13)

It should be noted that in (16), (19) and (21) MOVEMENT FORWARDS metaphors are combined with expressions associated with seeing; the latter are related to the conceptual metaphor UNDERSTANDING IS SEEING (Grady 1997). Interestingly, these visual metaphors also imply a gradation of the distance: remote but visible *horizon* (19),

possibly out of sight *vision* (21) and only in the mind's eye, as in the *dream scenario* in (16).

The pair of statements in (22) and (23) are slightly different. In this text, the journalist may have felt rather safe in claiming a *breakthrough* since the scientist had stated that they were 'on the edge', implying that they are only a step away from something revolutionary:

(22) ARK THERAPEUTICS will today announce one of the biggest *breakthroughs* in gene-based medicine to date when it unveils plans to test a new chemotherapy treatment for cancer that will put an end to side-effects such as hair loss, nausea and vomiting. (ti32)

(23) Nigel Parker, Ark's chief executive, told *The Times* last night that initial tests in the laboratory were very promising: "Essentially, the way this medicine works will allow us to deliver a lot more cancer-busting drug to the tumour more effectively and more safely. This puts us right *on the edge* of a next generation of drugs that will be developed from gene-based science. There really is nothing out there quite like it." (ti32)

With regard to the text location of the metaphor, of the 18 occurrences classifying the research as a *breakthrough*, four appear in the headline of the article and five are situated in the lead, suggesting that this metaphorical expression is exploited by the journalists to confer newsworthiness on their articles.

Advance. Another recurring way of characterising the outcomes of cancer investigations is through the metaphorical expression *advance*, which yielded 20 results in the English subcorpus. Of these, 14 evaluated the reported discoveries positively, all of which were in the singular whereas the remaining six (four of which were plural) provided a general view of scientific progress, as also occurred in a small number of cases of *breakthrough*. When realising the deontological appeal, *advance* was also premodified by intensifying adjectives: 'important' (3), '(most) significant' (3), '(very) major' (2), 'exciting' (1), 'great' (1), and 'key' (1). Of the three unmodified instances, one appeared in a prominent position, in a subhead announcing the discovery, and two were elaborated by other metaphorical expressions *open up* new approaches and *pave the way*:

(24) A cluster of genes which can make cancer cells thousands of times more sensitive to chemotherapy have been discovered by scientists, an *advance* that could *pave the way* for highly effective, pain free cancer treatment. (ep42)

In example (24), which corresponds to the lead of the article, the combination of the *advance* and *pave the way* contributes to both the deontological and teleological appeal, not only signalling the discovery as important scientifically but also pointing to the benefits to patients (pain free) and society as a whole, since highly effective treatments tend to reduce social costs.

With regard to attribution, as seen with *step*, both *advance* and *advances* were used by scientists/experts and journalists alike. However, in addition to the nouns, journalists also resorted to the verb *advance* (5 instances) in different forms to put recent developments in a broader perspective, an aspect that will be discussed below.

An isolated instance of the related metaphorical expression *headway* occurred in a statement made by the medical director of the charity funding the research, who was quoted in both newspapers:

(25) “It is always heartening to make *headway* when investigating a cancer like ovarian cancer, which is difficult to treat entirely successfully unless caught early. This work still has a *long way to go* in the laboratory before patients could benefit, but results *so far* are promising”. (gu13 and ti07)

Again the tone of the statement is one of cautious optimism as the progress is qualified by other MOVEMENT FORWARDS metaphors: *so far* and *long way to go*.

Reference points. Some discoveries are described as reference points, *milestone* and *landmark*, to indicate the position of scientific research on the *journey* towards a cure for cancer. The two references to *milestone* come from journalists and refer to the deciphering of the genome sequences of two types of cancers, lung cancer and melanoma, an event covered by both English newspapers but in somewhat different terms:

(26) The procedure gives doctors a profound insight into the biological causes of a patient’s cancer and marks a major *milestone* in progress towards personalised anticancer therapies and strategies to prevent the disease. (gu74)

(27) The exhaustive genetic maps, which catalogue every DNA mutation found in two patients’ tumours, will transform treatment of the disease. It has been described as the most significant *milestone* in cancer research in more than a decade. (ti72)

In (gu74) the scientific achievement was further qualified with expressions unrelated to the MOVEMENT FORWARDS source domain but also realising the deontological function,

including ‘a tour de force’, ‘a feat’, ‘a world first’ or ‘a fundamental moment in history’. In contrast, in (ti72) other MOVEMENT FORWARDS metaphors convey the significance of the investigation. Thus, in the headline cancer care is said to ‘take a giant *step forward*’; in the lead, the mapping of the genetic code of the two cancers is said to ‘*pave the way* for a medical revolution’; and the genetic information is also predicted ‘to *lead* to the development of powerful drugs’. The MOVEMENT FORWARDS theme is further developed in a quotation from an external expert who uses the other reference point image, *landmark*, and presents genomics as a fast moving object:

(28) “The *pace* at which genomics is *moving* is probably the most exciting thing that’s gone on in cancer research in more than a decade,” said Professor Sir John Bell, President of the Academy of Medical Sciences. “These cancer genome projects are a major *landmark*, as significant as the sequencing of the human genome itself.” (ti72)

In *The Guardian*, *landmark* appeared in four texts, in which the image is used in slightly different ways. In one text, the researchers were developing a diagnostic test based on what they considered a *landmark* study. In another, a scientist referred to his own study as a *landmark*, in what was clearly a self-promotional act. The other two were external evaluations, made by an expert and a journalist, of contributions to cancer treatment from the emerging fields of immunotherapy and metabolomics.

All the texts which presented scientific developments as *milestones* and *landmarks* dealt with significant achievements. In contrast, the following example, which illustrates the identification of a gene that appears to play a role in tumour growth, was classed by an expert from a cancer charity as a good *starting point* and was, therefore, presented as a more modest advance:

(29) “Understanding how cancer spreads is very important if we are to help more people survive the disease. This study adds to the evidence that Trop-2 is overactive in many cancer cells, and is a good *starting point* for further research into the role of this gene in cancer.” (ti48)

Obstacles. A number of metaphorical expressions which have intrinsically negative connotations appeared in the English texts. These include *hurdles*, *stumbling blocks* and *setbacks*, which depicted the problems that scientists may face in the pursuit of therapeutic solutions for cancer. However, these are usually converted into positive evaluations by showing how scientists have managed to overcome them. In only one text (ti69) did the *hurdles* convey a negative view of the current situation of cancer

research in that the elevated cost of genome sequencing and lack of knowledge about cancer biology still have to be resolved before personalised treatment becomes a viable option. In the other texts, in which the obstacles are surmounted, the research is cast in a highly positive light by stressing the perseverance of scientists in the face of adversity or their ingenious solutions to difficulties.

In (30), the scientists are said to have finally been rewarded for their labours over a long period of development when two new antibody therapies were approved for the treatment of a number of cancers:

(30) These antibodies have repaid the persistence of immunologists who have suffered serious *setbacks* in the pursuit of intelligent target-seeking therapies, particularly side effects associated with giving antibodies which are themselves small protein-like molecules. (gu10)

As seen in sample text 1 (gu40) and also in a comment on an example (22) from text (ti49) in chapter 6, the advances in drug design are innovative solutions that overcome the ‘big *hurdle*’ and the ‘*stumbling blocks*’ by what are described elsewhere in the articles as a ‘*stealth virus*’ and a ‘double whammy’. In the first case, the viral therapy is covered in polymer coat to protect it from the immune system and in the second, the innovation is the combination of two antibodies, also coated with an organic oil that temporarily makes them inactive, and then using a laser to break up the coat and spur them into action inside the tumour. Both solutions overcome the problem of delivering the treatment to the tumour, thereby sparing the surrounding healthy tissue.

In another article, the journalist developed the *stumble* image in an unconventional way to represent the fortuitous finding of a key gene in bladder cancer while the research was, in fact, focused on prostate cancer, thus converting potential failure into success:

(31) Scientists have *stumbled upon* a gene they think is responsible for bladder cancer sparking hope for finding an effective therapy. (gu15)

The metaphorical expressions from the MOVEMENT FORWARDS source domain presented so far in this section are those that contribute to the deontological function characteristic of press popularisation articles. With few exceptions, their role is to provide a positive appraisal of scientific outcomes, and scientists and journalists could add a graded adjective to the expressions to underscore the nature of the scientific achievement. However, the force of these metaphors was also seen to be toned down by hedges or by

pointing out the *long way* to a better understanding of cancer and to making diagnostic tests and effective therapeutic options available. These metaphorical expressions have also been shown to appear at prominent points in the texts, thus contributing to the newsworthiness of the articles.

Teleological appeal

A number of metaphorical expressions from the MOVEMENT FORWARDS source domain serve to signal the benefits that will derive from advances not only for the understanding of cancer but also when implemented in practical applications that will make a difference to cancer patients' lives. That is, they contribute to the construction of a teleological argument in which scientific outcomes are seen as positive because they "lead to further benefits" (Fahnestock 1986: 334). This is obviously highly relevant to the lay audience, who with the general increase in life expectancy are all potential cancer victims because the longer they live, the greater the chances of accumulating dangerous mutations in their genes.

Lead. The most common metaphorical expression is the verbal form *lead* (49 instances). Both journalists and scientists use this expression to make connections between a given discovery and a (potential) development in the management of cancer. It should be stressed that *lead* is a highly conventional metaphorical expression and, as such, in none of the texts was it marked with ostensive signals.

Of the total of 49 instances, 9 described how new current developments derived from previous advances mostly regarded as *breakthroughs* in cancer studies and management, such as the discovery of the p53 gene, which led to an explosion in the publication of articles on the role of this gene in different types of cancer, or the development of the breast cancer drug Herceptin.

However, the most frequent function of *lead* was to project the significance of a new discovery into the future. In this regard, *lead* was used tentatively and was accompanied by modal verbs, the most recurrent of which was 'could' (18 of 40 instances), possibly because this verb conveys the idea of practical potential. This was followed by 'will' (12 tokens), which expressed both a confident prediction or, when associated with

‘hope’ or ‘hopefully’, one of only slight optimism. In six instances, *lead* combined with *way* to form phraseological units that could emphasise the positive benefits through ‘new ways’ or ‘better ways’.

In the English subcorpus, the ultimate goals related to the reported discovery by *lead* were essentially of a practical nature, being related to improvements in treatments and therapies (20), developments of specific drugs or related products (9), and the introduction of diagnostic tests or procedures (4). In only 5 contexts was the new finding linked to benefit of a theoretical nature deriving from greater understanding of aspects of the disease.

(32) Researchers [...] have identified a gene which they hope will *lead* to the development of a new test to identify which prostate cancers are aggressive and have to be removed and which can be safely left untouched. (gu19)

(33) Eva Lee, lead author of the study [...] said: “We found that progesterone plays a role in the development of breast cancer by encouraging the proliferation of mammary cells that carry a breast cancer gene. Mifepristone can block that response. We’re excited about this discovery and hope it *leads* to new options for women with a high risk for developing breast cancer.” (gu38)

In (32) the identification of a gene may result in improvements in diagnosis through the development of a test that discriminates between aggressive and non-aggressive prostate cancers. In (33) an abortion drug (Mifepristone) could be used to halt cancer development because it can *block* the production of a hormone (progesterone) that fuels breast cancer cells. Thus, *lead* serves to connect developments in basic science with their potential applications in humans.

Preparing the way. A number of expressions that cover much the same ground as *lead* can be grouped together since they share the notion of preparing the road or starting out on a path towards a goal. These include *pave the way* (7 instances), *open the way* (5), *an avenue* (3) or *the door* (3) and *point the way* (1).

Pave the way is a fairly conventional metaphorical expression to signal the eventual application of a research outcome. *Open the way* could be seen as a prior stage, since an access to a route has to be created before paving, *open the door* places the emphasis on the outset of the journey and *point the way* indicates the direction to follow. In contrast,

opening an avenue could be interpreted as creating a new access through difficult terrain.

The 19 occurrences of these metaphors showed a similar pattern to that described above for *lead*. Only one of these adopted a historical viewpoint and also referred to the discovery of the p53 gene, which ‘*opened the way* for other researchers to begin the process of developing new forms of cancer treatment, prevention and detection’ (ti45). The remaining 18 instances pointed the way to future goals and were also attenuated by modality, including ‘could’ (6); ‘hope + will’ (2); and ‘likely to’ (1). In addition, 5 of the instances were in non-finite -ing clauses, offering an immediate interpretation for the reported discovery:

(34) A gene that determines the severity of breast cancer has been discovered, *opening the way* to tailored treatments for the disease. (ti16)

As with *lead*, the potential goals of the reported developments were of a practical nature, involving treatments of different kinds (10), reliable screening or improved genetic tests (2), or the development of drugs (1). The remaining five pointed towards further advances in theoretical knowledge or experimental research.

(35) “This [discovery of cancer stem cells] is likely to *open up new avenues* to understand better the underlying biology of cancer. It may also highlight ‘drugable’ targets for developing better medicine.” (ti30)

(36) The findings, reported in the journal *Nature Genetics*, *pave the way* for the first reliable screening test for men at high risk of the disease, but might also *lead* to new drug therapies for the condition. (gu55)

(37) The results, published in *Genes and Development*, could *point the way* to new treatments based on controlling Mitf levels. (ti41)

(38) The author of the study, Douglas Easton, [...], said: “We’re very excited by these results because the regions we identified don’t contain previously known inherited cancer genes. This *opens the door* to new research *directions*.” (gu45)

Examples (34)-(38) provide a fairly representative sample of the way in which these metaphorical expressions were used in the English subcorpus. However, one scientist elaborated on the *door* image by representing it as a minor obstacle that still had to be overcome:

(39) “We have tried for so long to kill these tumours and this is giving us a little opening. We are trying to *push* that *door* completely *open* and identify how to stop this gene working to cause disease.” (ti35)

With regard to attribution, the expressions *pave the way* and *open the way* seemed to be preferred by journalists (12 vs 2 instances) whereas statements containing *open up avenues* and *open the door* were all in quotes from scientists or experts.

Covering the middle ground

A number of texts contain linguistic metaphors expressing the distance that still has to be covered before the goal is reached. These images had as their nucleus the nouns *way* (5), *road* (1) and *destination* (1), and the distance was usually measured as ‘long’ in five articles or ‘not at hand’ in one case. In one text, the scientist who discovered the p53 gene stated that, despite the tremendous progress in understanding its biology, they still needed to develop a drug that could act against cells lacking this gene or with a defective copy by destroying them before they caused cancer:

(40) “That is the ultimate goal. We have a *way to go*, but we are confident. The last few years have been immensely encouraging.” (gu71)

In this case, the distance is not made explicit, but it is clear that this development is not imminent.

In another text that dealt with the man treated with cloned copies of his own immune cells, an expert assessed this singular case in the context of potentiating the immune system to eradicate cancer:

(41) The case showed that hopes to turn the immune system into a weapon against cancer was becoming a reality, Weiner added. “If the *destination* is not yet *at hand*, it is in sight. The endgame has begun.” (gu64)

As illustrated in these examples, the tone expressed is one of guarded optimism that, nevertheless, presents a more realistic evaluation of the relation between discovery and eventual applications than the teleological realisations discussed above. In six of the seven contexts in which a goal was perceived as being a long way ahead, the source of the statement was a scientist. Scientists who have made a considerable contribution to the progress of science are fully justified both in promoting their research and in boosting their professional and personal prestige through positive evaluation, and these more realistic assessments of where they stand can be seen as compensating for any tendency to overstate the significance of their achievements.

Interestingly, of ten instances in which the distance between discovery and a new goal was shortened by means of linguistic metaphors containing variants of the lemma *close* (*close* to 6, *closer* 3, *close in on* 1), only two could definitely be attributed to scientists. In spite of the choice of *close*, most of the contexts referred to progress towards a new stage in knowledge or in technical development in which the ultimate goal still lay some 10 to 20 years ahead:

(42) Sir David Lane, chief scientist at Cancer Research UK, will reveal on Wednesday that teams are *closing in on* techniques that are likely to *lead* to the creation of a new generation of drugs to combat major cancers. (gu71)

In a minority of cases, however, practical applications were expected in the near future, as in the case of the drug dasatinib, which can be used as rescue therapy in patients who do not respond to Glivec, and was reported as being ‘*close* to winning a licence in the US’ (ti37), or in the confident prediction from an oncologist who has helped to develop a vaccine for prostate cancer about to be tested in a trial:

(43) He said: “There have been problems with some of these therapies such as resistance building up as the cancers themselves change, but I think overall it’s positive, and that we are *close* to having active cancer vaccines for many people.” (gu33)

The different viewpoint of the journalists could be related to their role as science commentators, which involves a double responsibility: to the newspaper so that they have to make science attractive through the deontological appeal – hence the prominence given to *breakthrough*, *milestone* and the grading of *step* and *advance* described above – and to the general public through the teleological appeal, by underlining the social benefit to be derived from science. The latter is reflected in the way they bring the events closer in time and space to those who also have a stake in the successful application of new discoveries.

Besides the expressions measuring the distance between the discovery motivating the news story and its fruition, a variety of metaphorical expressions drawn from the MOVEMENT FORWARDS source domain, including phraseological units with *way*, *route*, *path* and the verbs *advance* and *move*, were found to cover this middle ground, which metaphorically appears to be controlled by journalists. Journalists could also, in some contexts, vary the frame of reference by introducing the RACE (Nerlich 2009) or EXPEDITION (Nerlich 2005b) scenarios within the more general domain of MOVEMENT

FORWARDS. It is in this middle ground, whose extension is vague but, as we have seen, it often takes years or even decades to cross, that journalists break with the classical view of the steady uniform linear progress of science and the incremental advance of knowledge (Petersen 2005).

Those aspects such as clinical trials that are situated near the goal of full application and availability are said conventionally to be *under way* and work directly related to conducting trials is described as *advanced*, although this may depend on the type of patient and where the research is being carried out:

(44) Work on predicting the course of a cancer by examining the cells is far *advanced* in children's cancers compared with adult cancers. (ti04)

(45) In London, the trials of Tookad are less *advanced* [than in Toronto] but have shown promise. (ti26)

Speed is variable and can be an illusion in the progress of knowledge and in drug development. One text initially paints a negative picture of STI571, which was in a small phase 1 trial in June 1998:

(46) It was just another obscure chemical going into trials, one of the thousands of candidate drugs which are *crawling their way* through the development chain from basic science towards the pharmacy.(gu08)

However, by May 2001, under the name of Glivec, it had been licensed by the US Food and Drug Agency (FDA) in 'a record time from trial to prescription pad'. In the case of Avastin, which was rapidly approved by the FDA for colorectal cancer in 2004, approval for Europe and the UK was announced in a headline: 'First cancer drug to starve tumours *on way* next year' (ti12), a promise fulfilled in January 2005, when it was approved by the European Medicines Agency (EMA). However, the process of refining experimental treatments is not always straightforward and the benefits have a price:

(47) Experiments to ascertain the right dosage, for example, may involve suffering *along the way*. (gu67)

Patients may get some consolation from the fact that the staples of radiotherapy and chemotherapy 'have also *advanced* considerably in recent years, improving their efficacy and reducing side-effects' (ti43).

The references to speed evoke the RACE frame, but a more appropriate SPORTING scenario for this middle ground might be ORIENTEERING. Thus, over some terrains progress is easier and, therefore, much quicker. The new fields of genetics, genomics and proteomics are not only themselves moving rapidly, but are helping other areas such as diagnosis at the same time:

(48) The *rapid advance* of genetic technology is likely to make the technique a routine procedure for cancer patients within 10 years. (gu74)

(49) One of the most fruitful *paths* is seeking links between inherited genes and cancers that run in families. This is one of the *most rapidly advancing* fields of medicine. (ti45)

As in orienteering, choosing the right *path* or *course* is essential, but a successful one may not be linear. Historically, this is illustrated by the development of new drugs from observations made concerning mustard gas:

(50) This observation eventually *led* by a circuitous *route* to the introduction of the first cytotoxic – cell-destroying – drugs. (ti25)

In contrast, an important paper on research into developing a simple blood test for ovarian cancer was fast-tracked through the publication process, ‘taking weeks instead of months to *travel* the usually tortuous *route* from acceptance to print’ (ti01). Unfortunately, in this case, the direct route was of no avail as the project later ran into difficulties and has yet to reach fruition.

In the EXPEDITION frame, since cancer is genetic in origin, journalists also place genomics and proteomics to the fore:

(51) It is a remarkable coup for the brave new world of proteomics, the next *frontier* beyond the genome. Each gene is a recipe for making a protein, and the goal of proteomics is to understand how these proteins work. (ti01)

Within this frame, scientists are portrayed as the *pioneers*, but this is done through their *pioneering* techniques, such as the stealth virus, or the *pioneering* approach of nanotechnology. The image is also evoked through verbs. Thus, Cassian Yee *pioneered* the new therapy in the man who received his own CD4 T cells to boost his immune response against melanoma. Similarly, the lead in another article announced a new test in which the metaphor was strikingly combined with a user-friendly image for aggressive and non-aggressive tumour types:

(52) Specialists are *pioneering* a genetic test that differentiates aggressive “tiger” cancers from the slower “pussycat” kind and child sufferers in particular could benefit. (ti04)

The positive portrayal of research with this scenario may be required because, despite the speed of progress, the discoveries are likely to take longer before they are fully implemented or generalised. But the *pioneering* approach to breast cancer also marks a change in direction, the aim being to make the disease manageable, converting it from a lethal disease into a chronic one like diabetes.

These changes in direction were also expressed through other MOVEMENT metaphors and referred to other entities with a vested interest in cancer research or were voiced by spokespersons for cancer charities that sponsor a great deal of this investigation. In the first case, the journalist resorted to the nautical metaphor *change tack* to represent the change in attitude of technology transfer companies, which initially served to protect the intellectual property of the charities from the large pharmaceutical companies, but is now much more forward-looking and is *building bridges* between scientists and the latter:

(53) But increasingly it has *changed tack* and initiated a good number of biotechnology companies each focused on a specialist molecule or molecules which would *lead* to the development of products which in time and if successful would be snapped up by the large pharmaceutical giants. (gu10)

The changes in trends in cancer research and treatment are often conveyed by the verb *move*, particularly in quotes from the cancer charities, firstly to represent the shift towards personalised therapy:

(54) Doctors and scientists in the pharmaceutical industry are *moving on* from cytotoxic drugs to produce targeted anti-cancer treatments that spare healthy tissue and destroy the malignant. (ti25)

However, more radical changes are being introduced by these charities, which to a large extent set the agenda for cancer research. Thus, Kate Law, head of clinical trials at Cancer Research UK, announced a shift in emphasis away from Nobel prizes towards the patients’ benefit:

(55) “There is no point funding laboratory studies if they do not benefit patients. So we are *moving* our efforts towards the patients’ end of things, from the first in-man trials right through to those that change clinical practice in the UK.” (ti44)

Moreover, Lesley Walker, the charity's information director, points out with another MOVEMENT FORWARDS metaphor in relation to a discovery related to apoptosis, that just as it is now accepted that there will not be a 'magic bullet', cancer research is not moving along a single route:

(56) "This eye-opening discovery has created an entire *map* of new *routes* to explore in the search for new therapy targets." (ti61)

As stated above, most of the metaphors that cover this middle ground come from the journalists, who nevertheless must draw on and elaborate those used by scientists and representatives of the cancer charities. Through the MOVEMENT FORWARDS source domain and related RACE and EXPEDITION frames, each of these participant groups confer their particular slant on topic and text. The scientists' angle is self-promotion and a slightly pessimistic view of the goal on the distant horizon. The journalists have to convert the science into an attractive news item and, at the same time, offer a more optimistic view, where the illusion of speed and vagueness of the distance involved, can make the benefits appear like a mirage to lay readers. The charities, for their part, must support both the research they have funded and the scientist that carried it out, but, since they hold the purse strings, they adopt a more critical attitude and provide a more realistic view in the long term. However, it is the journalists who control the discourse choosing where to place the attention seeking images and where to insert the quotes from both scientists and spokespersons so that they are the ones who ultimately put the *advances* in scientific knowledge and *breakthrough* discoveries into perspective.

10.4 Analysis of the Spanish subcorpus

10.4.1 Quantitative analysis

A total of 100 texts (67%) from the Spanish subcorpus contained at least one metaphorical expression from the MOVEMENT FORWARDS source domain. As in the English subcorpus, these expressions were used sporadically in the articles. Table 10.2 summarises the metaphorical expressions identified under the MOVEMENT FORWARDS source domain.

Table 10.2 MOVEMENT FORWARDS metaphors in the Spanish subcorpus

	<i>El</i> <i>País</i>	<i>El</i> <i>Mundo</i>	Total		<i>El</i> <i>País</i>	<i>El</i> <i>Mundo</i>	Total
Avance	36	26	62	Dirección	0	2	2
Paso	21	30	51	Embarcar	1	1	2
Avanzar	11	8	19	Mapa	1	1	2
Abrir vías	6	9	15	Recorrido/ recorrer	2	0	2
Abrir puerta	4	7	11	Rumbo	2	0	2
Camino	4	7	11	Senda	1	1	2
Marcha	3	7	10	Abrir avenidas	1	0	1
Cerca	6	2	8	Abrir dirección	0	1	1
Pionero	3	5	8	Alejado	1	0	1
Obstáculo	2	3	5	Andadura	0	1	1
Vía	4	1	5	Buque insignia	1	0	1
Salto	4	0	4	Caminata	1	0	1
Aceleración	3	0	3	Carrera de fondo	1	0	1
Destino	0	3	3	Carretera	0	1	1
Frontera	3	0	3	Colofón	0	1	1
Hito	2	1	3	Desencaminados	0	1	1
Lejano	2	1	3	Escollo	0	1	1
Lejos	1	2	3	Hoja de ruta	1	0	1
Punto de partida	2	1	3	Locomotora	1	0	1
Abrir caminos	1	1	2	Peldaño	0	1	1
Barrera	1	1	2	Ruta	1	0	1
Dar luz verde	1	1	2	Travesía del desierto	1	0	1

Metaphorical expressions from the MOVEMENT FORWARDS source domain are also fairly recurrent and varied in the Spanish subcorpus. However, whereas the English subcorpus clearly exploited five expressions – *lead*, *step*, *breakthrough*, *way* and *advance* – the Spanish subcorpus only contained three expressions with high numbers: *avance* (‘advance’), *paso* (‘step’) and *avanzar* (‘to advance’), although the phraseological units

centred on *abrir* ('open'), which are shown separately in the table, were also numerous when combined (30 instances).

10.4.2 Qualitative analysis in the Spanish press

Deontological appeal and other functions

Metaphorical expressions realising the deontological appeal in the Spanish subcorpus included *paso* ('step'), *avance/s* ('advance/s'), *salto* ('leap'), *hito* ('landmark' or 'milestone'), *punto the partida* ('starting point'), *obstáculo* ('obstacle') *barrera* ('barrier') and *escollo* ('rocky reef').

Paso. The metaphorical expression of *paso* ('step') was recurrent with a total of 51 instances. In contrast to the English subcorpus, in which expressions containing *step* performed two functions, namely, to signal the next stages of the research and to evaluate the outcome of the research motivating the newspaper report, in the Spanish subcorpus, four functions were identified for expressions containing *paso*. In addition to those mentioned above, for which there were 16 and 23 instances, respectively, the Spanish texts explained the overall progress of research in terms of *pasos*, and journalists also used 'primer *paso*' ('first step') non-evaluatively in a sequential manner, sometimes linked with 'siguiente *paso*' in the 'next step' function.

For the general overview of the research process (7 instances), the journalists usually relied on direct or indirect quotes from scientists or other experts in the field:

(57) "La quimioterapia indiscriminada, como la concebimos desde hace medio siglo, desaparecerá en menos de 10 años para *dar paso a* los tratamientos individualizados", asegura Rafael Rosell. (ep23)⁹⁹

Here, the expert uses the expression *dar paso* ('give way') to signal the change in approach to cancer treatment.

⁹⁹ "Indiscriminate chemotherapy, as we have conceived it for over half a century, will disappear in less than 10 years to *give way* to individualised treatments," assured Rafael Rosell.

In another text, two cancer experts, José María Fernández Sousa, quoted directly, and Manel Esteller in an indirect quote, emphasise that progress in the understanding of cancer will be achieved in a gradual, steady manner:

(58) “Iremos *paso a paso*, pero será una progresión geométrica y no aritmética, como hasta ahora”. Manel Esteller tampoco espera grandes *pasos adelante* en esta *carrera de fondo* que es la *guerra* contra el cáncer, pero cree que los *avances* logrados son ya esperanzadores. (ep06)¹⁰⁰

Although Fernandez Sousa explains that scientists will go ‘*step by step*’, he predicts an acceleration through geometric rather than arithmetic progression; in contrast, Esteller, somewhat pessimistically, admits that he does not expect big *steps* forward in cancer research, in a striking combination of the RACE and WAR scenario.

This general function in the Spanish subcorpus is related to the more varied approach to science reporting in the Spanish newspapers, which not only cover contributions made by individual studies but often situate one or a number of studies within the broader view of cancer research and management:

(59) Una porción nada despreciable de las moléculas están ultimando ya los últimos *pasos* de la investigación preclínica o incluso se han incorporado a las primeras fases de los ensayos con humanos. (ep04)¹⁰¹

Here the journalist makes a special effort to relate discoveries in basic science to their use as treatments, which is what is most relevant to the general public. Since it takes a drug an average of 15 years to reach the market, and less than 10% eventually make it, the journalist closes the article by quoting the Spanish scientist Massagué, who draws on the MOVEMENT FORWARDS source domain to claim that many of these molecules are now more than half *way* there and application may be imminent in some cases:

(60) En el momento actual, zanja, se ha recorrido “más de la mitad del *camino*” para muchos de ellos. La traslación a la realidad puede ser incluso “inminente” en alguno. (ep04)¹⁰²

¹⁰⁰ “We will go *step by step*, but it will be a geometrical rather than the arithmetical progression it has been till now.” Manuel Esteller does not expect big *steps forward* in this *long-distance race* that is the *war* against cancer, but believes that the *advances* achieved are already encouraging.

¹⁰¹ A not insignificant proportion of molecules are now reaching the last *steps* in preclinical research or have even been incorporated into the first phases of trials in humans.

¹⁰² At the present moment, [Massagué] declared, we have come “more than half the *way*” for many of them. Transfer to reality may even be “imminent” for some.

Thus, unlike *step*, which always made a deontological appeal, *paso* alone or combined with other MOVEMENT FORWARDS metaphorical expressions, also served to cover the middle ground in the Spanish subcorpus.

In the non-evaluative sequential function (4 instances), ‘primer *paso*’, usually accompanied by ‘siguiente *paso*’, was used by the journalist to mark the discourse rather than assess the research in an overt manner:

(61) La aprobación del uso de los inhibidores de los proteasomas (el bortezomib) para tratar el mieloma (un tipo de cáncer de médula) es sólo el primer *paso*. [...] Por eso el Grupo Español del Mieloma, un conjunto de especialistas de casi 80 hospitales, está preparando el siguiente *paso*: su aplicación en enfermos mayores de 65 años, y su uso combinado con otros fármacos o como primera línea de tratamiento. (ep17)¹⁰³

Between the two parts of (61), the journalist explains that the treatment has only been approved for use in a limited number of patients – those who have failed to respond to other drugs – and trials are already under way; what they now seek is to extend its use to a much larger patient population. Thus, in this case, the journalist is not evaluating the work as a breakthrough.

As in the English subcorpus, most of the 16 instances when *paso* collocated with ‘siguiente’, or in one case with ‘próximo’ (‘next’), indicated the subsequent stage or stages of the research and thus indirectly labelled the investigation of the news report as a *step forward*, the positive assessment sometimes being underlined elsewhere in the article through another evaluative MOVEMENT FORWARDS metaphor such as ‘último *avance*’ (‘latest advance’):

(62) Los siguientes *pasos* de los investigadores están destinados a determinar si TGFB y Angiopoitina también están activas en otros tipos de tumores, y buscar la manera de interferir en la acción de estas moléculas. (ep63)¹⁰⁴

In two texts covering the same story, it was the achievement reported that was designated the ‘siguiente *paso*’ (‘next *step*’), since it marked significant progress in the

¹⁰³ Approval for use of proteasome inhibitors (bortezomib) to treat myeloma (a type of bone marrow cancer) is only the first *step*. [...] For this reason, the Spanish Myeloma Group, a group of specialists from almost 80 hospitals, is preparing the next *step*: its application in patients over 65 years of age and its use combined with other drugs as a first-line treatment.

¹⁰⁴ The next *steps* for the researchers are aimed at determining whether TGF- β and angiopoietin are also active in other types of tumour and to find a way to interfere with the action of these molecules.

development of an experimental model in nanotechnology, which requires more work before being put into practice:

(63) El siguiente *paso*, que se publica ahora en la revista ‘*Proceedings of the National Academy of Sciences*’, ha sido introducir estos nanotubos dentro de las células malignas, pero no en las sanas. (em12)¹⁰⁵

In the Spanish subcorpus, journalists dominated this function (13 of 16 instances) whereas in the English subcorpus it was shared by journalists and experts (5 and 6, respectively).¹⁰⁶

In the contexts in which *paso* made the deontological appeal (23 instances), the reported discovery was assessed by both experts and journalists, with a slight predominance of the former (14 vs. 9). However, a notable difference between the subcorpora is the general absence of intensifying adjectives in the Spanish articles. In addition to four contexts in which ‘primer *paso*’ evaluated the reported research positively, there were only five instances of graded adjectives: ‘importante’ (2) (‘important’), ‘gran’ (1) (‘big’), ‘de gigante’ (1) (‘giant’), ‘significativo’ (1) (‘significant’), four of which came from scientists, and could, therefore, be regarded as self-promotional. The remaining case appeared in an article on the genetic map of a lung tumour, where the journalist classified the scientific outcome as a ‘*paso de gigante*’ (‘giant *step*’), but placed the emphasis on the work that remains to fully understand the biological complexity of lung cancer:

(64) A pesar del *paso de gigante* que este trabajo representa, los autores reconocen que aún serán necesarias muestras de tumores más amplios y nuevos trabajos para seguir comprendiendo la complejidad genética y molecular del cáncer de pulmón. (em51)¹⁰⁷

In fact, in the Spanish articles, the force of the metaphor is frequently toned down both by the journalists and the experts. Thus an external expert commenting on Yondelis, a drug used in the treatment of advanced soft tissue sarcoma, classed it as a *step*, but not a revolutionary one, because it only prolongs the patient’s life expectancy some months and does not represent a cure.

¹⁰⁵ The next *step*, published today in the journal *Proceedings of the National Academy of Sciences*, was to introduce these nanotubes into the malignant cells but not into the healthy ones.

¹⁰⁶ There was also one context not included in the count for ‘siguiente’. In ‘el *paso* a ensayos en humanos no es inmediato’ (ep73) (‘the *step* to trials in humans is not imminent’), the bare *paso* implies a remote ‘next’ step.

¹⁰⁷ In spite of the giant *step* that this paper represents, the authors recognise that broader tumour samples will be necessary and further studies to understand the genetic and molecular complexity of lung cancer.

For the deontological function, the most recurrent expression (10 instances) was the simple ‘un *paso* más’(‘one more step’). However, this *paso* metaphorical expression could in some cases be further elaborated through other expressions from the MOVEMENT FORWARDS theme in order to clarify the meaning of the term and the implications for a better understanding of the biology of cancer and management of the disease. For instance, in an article on a symposium held in Madrid to commemorate the isolation of the first oncogene, Spanish biologist Mariano Barbacid, who led the American research team, comments on this scientific feat:

(65) Aunque Mariano Barbacid, su principal investigador, subraye que es el resultado de muchos esfuerzos y también del trabajo desarrollado antes por otros científicos, admite que “supuso un *paso* importante, pero un *paso* más en una larga e interminable *caminata*”. No obstante, insiste en que este *hito* fue posible gracias al desarrollo de una avanzada tecnología por científicos como el holandés Van der Erb y los norteamericanos Michael Wigler y Richard Axel. (ep56)¹⁰⁸

Barbacid rightly acknowledges that his team’s work was an ‘important *step* forward’, but also stresses that it was just one *step further* in a long and interminable *trek*. In contrast to previous examples where *step* occurred in isolation, Barbacid’s quotation is more informative in that he provides more context that can be used to make sense of the progression made to date. Having clarified this, he adds that it was a *landmark* made possible thanks to the work of Dutch and American scientists. It should be noted here and throughout this discussion of the Spanish subcorpus that journalists place a strong emphasis on boosting the prestige of Spanish science and researchers both at the national level and in the international context, by introducing quotes from their leading scientists, such as Barbacid, Massagué and Baselga, and by stressing the participation of Spanish institutions and investigators in international projects.

In the lead of text (em46), which reports on an isolated case in which the patient’s own T cells were modified and then injected treat his melanoma, experts in the field assess the implications in an indirect quote:

(66) Sin embargo, y a pesar de que la comunidad científica reconoce el valor de este nuevo trabajo (que, sobre todo, da idea de que se está *yendo por buen camino*), entre los especialistas ha calado un sentimiento de cautela y cierta preocupación. En primer lugar,

¹⁰⁸ Although Mariano Barbacid, the principal investigator, underlines that it was the result of great effort and also of work carried out before by other scientists, he admitted that “it represented an important *step*, but one *step* more in a long and interminable *trek*.” Nevertheless, he insisted that this *landmark* was possible thanks to the development of the advanced technology by scientists such as the Dutchman Van der Erb and the Americans Michael Wigler and Richard Axel.

advierten de que éste es un *paso* más en una *senda* que lleva ya tres décadas abierta y que no es otra que la de lograr que el sistema inmunológico del propio paciente acabe aniquilando los tumores. (em46)¹⁰⁹

The experts, therefore, elaborate the *paso* metaphor with another two expressions from the MOVEMENT FORWARDS theme to place the achievement in perspective: *yendo por buen camino* (‘going the right way’) along a *senda* (‘path’) that has been open for 30 years. In spite of this caution, the writer later classifies this clinical case report using an even more striking image – ‘uno de los *colofones* de esta *andadura*’ (‘one of the *high points* along this *path*’) – thus, making it a *landmark*.

Avance. In the Spanish subcorpus, metaphorical expressions based on the nominal forms *avance/s* (‘advance/s’) are even more frequent (62 instances) than those with *paso*. Of this total of 62 the plural form outnumbered the singular form (45 vs. 17) and the broad perspective covering the middle ground, almost always realised by the plural form *avances*, predominated (45 instances), with the remaining 17 occurrences performing the deontological assessment of the scientific advance. With regard to attribution, of the 45 instances giving the broad view of scientific progress, 37 corresponded to journalists and only 8 to scientists or other experts in the field, whereas the deontological function was shared equally by journalists (8) and scientists and experts (9).

The broad perspective was particularly evident in certain long articles which covered conferences such as the Annual Meeting of the American Society of Clinical Oncology (ASCO) (ep23) or the World Conference of the International Association for the Study of Lung Cancer, held in Barcelona, (ep26), or a special symposium organised by *El Mundo*, which brought together nine specialists to deal with aspects of prostate cancer (em06). These articles included seven, six and four instances of *avance/s*, respectively, only one of which evaluated a specific achievement – namely, that of the drug trastuzumab (also known as Herceptin) in the treatment of certain breast cancers – in which the Spanish oncologist Baselga was involved:

¹⁰⁹ However, although the scientific community acknowledges the value of this new paper (which above all gives the impression that they are *going the right way*), specialists have a deep sense of caution and a certain preoccupation. In the first place, they warn that this is one *step* more along a *path* that has been open for three decades and is no other than the one to get the patient’s own immune system to annihilate tumours.

(67) La acumulación de *avances* significativos en los últimos años está cambiando drásticamente el porvenir de muchos enfermos. Un caso ilustrativo es el de las mujeres afectadas por un cáncer de mama especialmente agresivo, el del tipo HER-2, que representa el 20-30% de todos los tumores mamarios. [...] Este *avance* en el tratamiento de un tumor es, a juicio de Baselga y otros expertos, el más significativo de los muchos presentados la semana pasada en la 41 reunión anual de ASCO. (ep23)¹¹⁰

Interestingly, of the 17 instances with the evaluative function, eight were graded: ‘gran’(3) (‘big’), ‘pequeño’ (2) (‘small’), ‘significativo’ (‘significant’), ‘apasionante’ (‘exciting’) and ‘intrigante’ (‘intriguing’) (once each); all but one of these graded evaluations were made by scientists or experts. These instances of *avance* frequently co-occurred with other evaluative expressions from the MOVEMENT FORWARDS source domain. Of particular interest is the assessment by a specialist concerning a lung cancer study in which he was involved. Initially, in view of the poor survival time, the achievement is placed alongside others as a modest one, but in terms of the method employed, he later claims it to be not only an *hito* (‘a milestone’) for Spanish oncology, but also a world first:

(68) En este tipo de cáncer, cuya supervivencia con quimioterapia ronda actualmente los 11 meses, “los *avances* son pequeños” tal y como reconoce este especialista, por lo que cualquier pequeño *avance* es recibido con esperanza y cautela a partes iguales. [...]

“Éste es el primer estudio en el mundo que proporciona un tratamiento basado en el resultado de un análisis genético”, agregó el especialista, que lo considera todo “un *hito* a nivel de la oncología española”. (em09)¹¹¹

Salto. The *salto* (‘leap’) metaphorical expression yielded only four results, one of which appeared in the subhead of an article with an evaluative role:

(69) Massagué da un *salto* en la investigación del cáncer al encontrar las moléculas que evitan que las células tumorales de mama viajen a otros órganos. (ep58)¹¹²

The headline to this article was a rather hyped up statement from Massagué which read ‘La metástasis ya no nos asusta’ (‘Metastasis no longer scares us’). The triumphant tone

¹¹⁰ The accumulation of significant *advances* in recent years is drastically changing the future of many patients. An illustrative case is that of women with a specially aggressive HER-type breast cancer, which accounts for 20-30% of all breast cancers. [...] This *advance* in the treatment of a tumour is, according to Baselga and other experts, the most significant among the many presented at the 41st annual ASCO meeting.

¹¹¹ In this type of cancer, in which survival with chemotherapy is currently around 11 months, “the *advances* are small” as this specialist recognised, so that any small *advance* is received with hope and caution in equal measure. [...]

“This is the first study in the world that offers a treatment based on the result of a genetic analysis”, added the specialist, who considers it “a *milestone* in Spanish oncology.”

¹¹² Massagué takes a *leap* forward in cancer research by finding the molecules that prevent breast cancer cells from travelling to other organs.

of the headline, together with the qualification of the investigation as a *salto* is clearly a reader-attracting strategy.

The other three instances of this metaphor covered the middle ground. In one article a cancer expert foresees a qualitative *leap* forward in breast cancer, which, as seen in an English text in reference to the *pioneer* metaphor, will mark the end of breast cancer as a lethal disease:

(70) “Muy pronto. A partir de 2008”. La mejora en el diagnóstico y la posibilidad de dirigir tratamientos contra dianas biológicas específicas permitirá un gran *salto* cualitativo. En algunos tumores ya se vislumbra: “Llegará un día en que el cáncer de mama dejará de ser causa de muerte. Y lo vamos a ver nosotros”, vaticinó. (ep13)¹¹³

In the remaining two contexts, *salto* referred to the transfer from basic science research to applied science, with the metaphorical expression placing an emphasis on the gap separating the two disciplines, as pointed out by an oncologist involved in developing nanoparticles:

(71) “[...] pasar de los cultivos en laboratorio a testarlo en humanos es un *salto* muy importante que no siempre resulta”, concluye. (ep67)¹¹⁴

Similar reservations are expressed by a Canadian researcher working with cancer stem cells, where the leap will have to overcome the ethical problems:

(72) Los investigadores han identificado varios marcadores que les permiten identificar estas células madre del cáncer, pero necesitan más. El problema con el modelo de las células madre del cáncer es que por ahora se ha demostrado sólo en animales; para el *salto* a humanos habría que trasplantar a una persona células tumorales de otra, con los consiguientes problemas éticos. (ep55)¹¹⁵

Reference points. The description of scientific outcomes as *hitos* (‘landmarks’ or ‘milestones’) is fairly rare in the Spanish subcorpus, with only three instances of the metaphor. We have already seen how the first application of gene analysis was classified as a milestone in Spanish oncology (example 68) and also, from a historical

¹¹³ “Very soon. After 2008”. The improvement in diagnosis and the possibility of directing treatment at specific biological targets will result in a great qualitative *leap* forward. For some tumours, we have already had a glimpse of this: “The day will come when breast cancer will no longer be a cause of death. And we will see it,” he predicted.

¹¹⁴ “[...] going from cultures in the laboratory to testing in humans is an important *leap* that is not always successful,” he concluded.

¹¹⁵ Researchers have identified several markers that allow identification of these cancer stem cells, but they need more. The problem with the cancer stem cell model is that so far it has only been demonstrated in animals: the *leap* to humans would involve transplanting tumour cells from one person to another, with the consequent ethical problems.

standpoint, how the Spanish scientist Barbacid described the discovery of the first oncogene as an *hito*, but did so against the background of cancer research as a long and interminable trek (example 65).

The third instance occurred in the context of translational science, i.e., the transformation of scientific discoveries arising from laboratory, clinical, or population studies into clinical applications to reduce cancer incidence, morbidity, and mortality. The Spanish scientist Baselga heads a programme investigating 16 molecules that are candidates to become drugs, all of which are currently in trials with patients:

(73) La cifra representa todo un *hito* para la investigación clínica española, hasta hace pocos años *alejada* de los circuitos de ensayos. El número también sitúa el programa entre la élite mundial: de los últimos seis fármacos aprobados por la todopoderosa Agencia Federal del Medicamento (FDA) norteamericana desde 2000 hasta la fecha, cuatro han sido codesarrollados entre el equipo barcelonés y la gran industria farmacéutica. (ep05)¹¹⁶

This is described not only as a *landmark* in Spanish clinical research but also one that has established the research group internationally. In this example, it is again evident how Spanish journalists adopt the broad view with such landmark studies, and Baselga himself points out that the aim is to ‘transportar con rapidez un medicamento desde la probeta a la cama del enfermo’ (‘to quickly transport a drug from the test tube to the patient’s bedside’), thereby shortening the time taken to cover the middle ground between the breakthrough and the realisation of social benefits.

Two texts in which more modest developments were presented classified them as a *punto de partida* (‘starting point’). In one, the scientists had created a transgenic “supermouse”, a model that would serve in the development of future anticancer drugs and the second dealt with nanoparticles that still awaited clinical applications.

Obstacles. As with the English subcorpus, problems faced by scientists on their way to improvements in cancer therapies are presented as obstacles. These include *obstáculo* (5) (‘obstacle’), *barrera* (2) (‘barrier’) and *escollo* (1) (‘rocky reef’). In the English

¹¹⁶ The figure represents a *landmark* for Spanish clinical investigation, which until the last few years was a long way from the trials circuit. The number also places the programme among the world élite: of the last six drugs approved by the all-powerful American FDA since 2000, four have been co-developed by the Barcelona team and the giant pharmaceutical industry.

subcorpus, three of four instances of similar expressions were seen to carry a positive evaluation of the studies reported in the news stories, since scientists managed to overcome the difficulties. In the Spanish subcorpus, of the eight instances of these metaphors, four occurred in the context of specific discoveries, which were evaluated as a success or partial success. The remaining four conveyed a negative view of aspects related to cancer research: namely, the practical obstacles standing between basic and applied science, especially the administrative barrier of obtaining drug approval from the FDA or EMA (ep06); the challenges presented by the multiple gene mutations (ep66); and the elevated cost of personalised cancer treatment (em45). In the context of administrative barriers, obtaining drug approval is represented as the opening of traffic lights (*dar luz verde*, ‘give the green light’), which in the case of nanotechnology means obtaining permission for both the vehicle (virus or protective coat) and the load (active agent).

Although the *hurdle* image seen in the English texts evokes the RACE scenario, the Spanish *obstáculo* and *barrera* have a wider range of reference frames. One Spanish text described how the Spanish scientist Massagué had discovered the key gene that allows breast cancer cells to cause brain metastases and showed how the research had not only solved the enigma of tumour cells passing through the literal *barrera* hematoencefálica (‘blood-brain barrier’) but had also overcome the metaphorical *obstáculo* of isolating cells in brain metastases, opening up the possibility of new treatments. Similarly, Spanish researcher María Soengas explained a major difficulty of dealing with all the multiple mutations in melanoma:

(74) El problema del melanoma es que sus células acumulan tantas alteraciones que hasta ahora ha sido difícil buscar mecanismos capaces de superar todos estos obstáculos. (em67)¹¹⁷

A theoretical solution provided by Soengas’ research group involves a combination of nanotechnology and an agent that induces the cancer cells to self-destruct by autophagy, a solution that is now being tested in a trial.

Another article, also dealing with melanoma, resorts to a more creative nautical metaphor to explain why little progress had been made regarding survival:

¹¹⁷ The problem with melanoma is that its cells accumulate so many alterations that until now it has been difficult to find mechanisms capable of overcoming all these *obstacles*.

(75) En cambio, en lo que se refiere a terapias apenas ha habido *avances*. En España se diagnostican alrededor 3.200 casos y se producen unos 700 fallecimientos anualmente.

El hecho de que la quimioterapia resulte prácticamente ineficaz en estos tumores sigue siendo el principal *escollo*. (em71)¹¹⁸

Thus, chemotherapy is depicted as ‘foundering on the rocks’; the literal meaning of *escollo* is a rocky reef. The research reported is a partial success in that it has identified a key gene (ERBB4), which holds out the promise of individualised treatment for some patients, but the journalist adds that the possibility of finding a useful drug for the majority of melanomas seems remote.

Teleological appeal

As regards the teleological appeal, in contrast to the English subcorpus, in which *lead* was the most representative member, in the Spanish subcorpus there was a notable absence of what can be considered direct counterparts, with only two instances of *conducir* (1) (‘lead’) and *llevar* (1) (‘lead’ or ‘take’) identified:

(76) Los descubrimientos, que se publican en el *European Journal of Cancer*, pueden *conducir a* unas mejores medidas de prevención contra el cáncer y podrían tener como resultado un mejor tratamiento. (ep32)¹¹⁹

(77) Los siguientes *pasos* de este equipo les *llevarán a* indagar el papel de los otros 14 genes descubiertos en 2005, así como su implicación en la aparición de metástasis en otros órganos diferentes de los pulmones (como los huesos o el cerebro). (em29)¹²⁰

It should be noted that, as occurred with English *lead*, when the goals are of a practical nature such as preventive measures (e.g. vaccines) and ultimately treatment, they are presented tentatively through modal verbs ‘pueden’ (‘may’) and ‘podrían’ (‘could’) so that they appear some way off. In contrast the theoretical advance in the understanding of metastasis is a more immediate goal and is confidently predicted through the plain future tense *llevarán* (‘will lead’).

¹¹⁸ On the other hand, with regard to therapies, hardly any *advances* have been made. In Spain around 3,200 cases are diagnosed and they result in 700 deaths a year.

The fact that chemotherapy is practically ineffective in these tumours remains the main *obstacle*.

¹¹⁹ The discoveries, published in the *European Journal of Cancer*, may *lead* to better preventive measures against cancer and could result in better treatment.

¹²⁰ This team’s next *steps* will *lead* to investigation of the role of the other 14 genes discovered in 2005, and of their implication in the development of metastases in organs other than the lungs (e.g. bones and the brain).

In view of the almost complete absence of expressions with minimal metaphorical weight, linguistic metaphors expressing greater metaphoricity, such as the opening of different types of routes, are more frequent overall in Spanish than in English. These metaphors mainly involved phraseological units in which the verb *abrir* ('open') was collocated with: *vía* (15) ('way'), *puerta* (11) ('door'), *camino* (2) ('way'), *avenida* (1) ('avenue') and *dirección* (1) ('direction').

Apart from a single instance describing a past discovery (ep37), the remaining 29 occurrences pointed to the future benefits, theoretical and practical, of a new development or discovery. In comparison with the English subcorpus, the expressions with *abrir* exhibited little modality and were most often found in the plain present (20), or by the present perfect (3), with only 5 instances expressed in more tentative verb forms: *abrirá* ('will open'), *pueden abrirse* ('can open'), *podría abrir* ('could open'), *se espera que abra* ('it is hoped will open'), *abriría* ('would open'), and one Spanish gerund *abriendo* ('opening').

A second difference with regard to the English subcorpus concerned the nature of the nearest goal towards which the research was heading. Whereas in the English subcorpus the practical applications clearly outnumbered the theoretical goals, in the Spanish texts the distribution was more balanced: treatment (14 instances) and diagnostic tests (4) compared to theoretical advances (11).

With regard to attribution, metaphorical expressions involving the teleological appeal were employed by both journalists and scientists or experts, as was also observed in the English texts, with a slight predominance of journalists (19 vs. 11 instances).

Although there appeared to be no direct equivalent of the English *pave the way*, in one Spanish text a journalist used the unusual variant of *peldaño* (a rung in a ladder or a step in a staircase), which evokes an ascending path and, therefore, conveys the positive connotations generally associated with upward movement:

(78) Sin embargo, en otro contexto muy diferente empiezan a verse evidencias que demuestran que el cannabis podría ser algo más: un agente terapéutico contra las células tumorales. Un grupo de investigadores españoles lidera esta vía de investigación, que esta semana ha puesto un nuevo *peldaño* en su *camino*. (em61)¹²¹

Thus, cannabis could be considered more than just a palliative treatment to counter the secondary effects of chemotherapy, such as fatigue and nausea, and could act against the tumour itself.

Covering the middle ground

In the Spanish subcorpus, the impressions created regarding the distance remaining between breakthrough and application vary considerably, ranging from the most optimistic views, in which the control of cancer is seen as just around the corner, to the pessimistic acknowledgement that there is still a long way to go.

Four articles from *El País* present the optimistic view on the distance still to be covered. In two of these, international scientists assess the current state of cancer research in direct quotes:

(79) “El cáncer dejará de ser causa de mortalidad. Estamos cada vez más *cerca*. Es algo imprevisible, pero ocurrirá”. “Estamos cada vez más *cerca*. No nos vamos a levantar un día y comunicar de repente que el cáncer se ha curado, pero lo cierto es que le estamos ganando día a día”. (ep07)¹²²

In this case, the Spanish researcher, Baselga, had just attended the ASCO meeting in 2004, where he had presented his recent success in treating a metastatic lung cancer with a targeted therapy gefitinib. Similarly, Robert Weinberg, following the discovery of Glivec, could also confidently “predict” in 2006:

(80) “Estamos *cerca* de poder abarcar todo el problema del cáncer”. (ep34)¹²³

These enthusiastic assessments can probably be attributed to the excitement caused by the achievements and the exhilaration surrounding the recently deciphered Human Genome. Retrospectively, though, both are clearly hyped up statements.

¹²¹ However, in another very different context evidence is starting to appear that shows that cannabis could be something more: a therapeutic agent against tumour cells. A group of Spanish investigators heads this line of research, which this week has added a new *step* to its *path*.

¹²² “Cancer will cease to be a cause of mortality. We are getting *closer*. It’s not something foreseeable, but it’ll happen”. “We’re getting *closer*. We’re not going to get up one day and suddenly report that cancer has been cured, but it’s true that we’re gaining day by day”.

¹²³ We’re *close* to being able to embrace the whole problem of cancer”.

In the other two articles, it is the journalists that show excessive optimism in their evaluations of recent developments in cancer research. On the basis of a single study of an animal model, one journalist concluded:

(81) Una vez más, la investigación, en este caso unida a la casualidad, vuelve a alimentar la esperanza de que un día no muy *lejano* acabaremos con la terrible lacra del cáncer. (ep37)¹²⁴

The second journalist opened his article covering the 41st ASCO annual meeting with the following more reserved claim about the future of personalised medicine:

(82) Las nuevas terapias moleculares y los tratamientos individualizados contra los tumores malignos auguran que el control del cáncer está más *cerca*. La reciente reunión de la Asociación Americana de Oncología Clínica confirma que los *avances* contra el cáncer están experimentando un proceso de aceleración. (ep23)¹²⁵

In contrast to these positive assessments from *El País*, in *El Mundo* personalised medicine was deemed to be a long way off:

(83) «La medicina personalizada, como concepto, es precioso». Lo dice Josep Ramón Germá, jefe del servicio de Oncología Médica del Instituto Catalán de Oncología (ICO), que pone voz a una cautela común en el campo de la oncología. Cada vez son más las dianas moleculares que se conocen y que permiten atacar al cáncer en su ‘talón de Aquiles’; cada día existen más fármacos ‘dirigidos’ y mejores ‘tests’ genéticos, pero aún queda mucho *camino por andar*. (em38)¹²⁶

In addition to these assessments of the general situation regarding the ultimate goals of cancer research, another group of texts dealing with the potential applications of specific discoveries also reflected a cautious approach. These could be expressed by grading the term *cerca* (‘close’), by looking into the distant future or by measuring the distance to be covered.

¹²⁴ Once again, research, in this case allied to chance, feeds the hope that one day not too *far off* we’ll eliminate the terrible scourge of cancer.

¹²⁵ The new molecular therapies and individualised treatments against malignant tumours augur that the control of cancer is *closer*. The recent meeting of the American Society of Clinical Oncology confirmed that *advances* against cancer are undergoing a process of acceleration.

¹²⁶ “Personalised medicine, as a concept, is beautiful”, according to Josep Ramón Germá, head of the department of Medical Oncology at the Catalan Institute of Oncology, which represents the common voice of caution in the field of oncology. More and more molecular targets are known, making it possible to attack cancer’s ‘Achilles’ heel’; every day there are more ‘targeted’ drugs and better genetic ‘tests’, but there is still a *long way to go*.

(84) Este hallazgo, que aún debe ser validado en otros estudios, y está más *cerca* de momento de los avances en ciencia básica que de las aplicaciones clínicas, podría algún día permitir detectar esta letal enfermedad mediante un análisis de sangre en lugar de por los métodos invasivos que hoy siguen siendo necesarios. (em54)¹²⁷

(85) El trabajo es interesante porque hay pocos de este tipo, indica Gomis. La patente ya está solicitada, por si el hallazgo se tradujera, en un futuro todavía *lejano*, en un nuevo tratamiento. (ep70)¹²⁸

(86) “Es un proceso muy largo y con riesgos”, alerta. Si en cuatro años finaliza con éxito la fase de investigación, aún quedará un largo *recorrido* para testar el fármaco en animales y personas. (ep67)¹²⁹

In (84) the diagnostic test is placed much closer to the starting point than to the eventual goal. In (85) a mechanism involving the protein prosaposin that could be used to inhibit angiogenesis has been patented as a guarantee in case a specific application should be developed, even though this is unlikely in the foreseeable future. Finally, in (86) a spokesman for a company researching into nanotechnology, while expressing his hopes concerning this new way of *attacking* cancer, recognises that the path from research to testing is a long one even in animals let alone humans.

As in the English subcorpus, the Spanish texts employed a variety of metaphorical expressions from the MOVEMENT FORWARDS source domain to cover the middle ground that stretches between scientific discovery and practical application. Besides the use of *paso* (‘step’), *avances* (‘advances’) and *salto* (‘leap’) already mentioned, this function was also realised by a number of the linguistic metaphors and phraseological units including *marcha* (‘march’), *vía* (‘way’), *camino* (‘way’ or ‘road’), and the verb *avanzar* (‘advance’). Journalists also draw on the EXPEDITION scenario, together with occasional references to a maritime or sporting frame.

In the Spanish subcorpus, conventional expressions with *marcha* (10 instances), including *en marcha* (‘under way’) or *poner en marcha* (‘set in motion’), collocated not only with clinical trials, but also with research projects and other multidisciplinary programmes such as the ‘programa Oncosur’ coordinated by the prestigious Johns

¹²⁷ This finding, which still has to be validated in other studies, and is *closer* to the point of *advances* in basic science than to clinical applications, could some day allow detection of this lethal disease with a blood test instead of invasive methods that are still necessary today.

¹²⁸ The study is interesting because there are few of this kind, indicated Gomis. The patent has already been applied for, in case the finding should lead, in a still *distant* future, to a new treatment.

¹²⁹ “It’s a very long and risky process”, he warned. If in four years the investigation phase ends in success, there will still be a *long way to go* to testing the drug in animals and humans.

Hopkins University with the participation of the most important hospitals in the southern Madrid area.

Vía even when not combined with *abrir* conveyed a similar meaning and potentially led to new treatments or diagnostic techniques, but sometimes implied a number of alternative paths or a change in approach. In contrast, contexts with *camino* could be marked with strong negative or positive connotations. Thus, scientists expressed their fear that they might have missed something important *en el camino* ('along the way'), and in view of the expense of drug research, pharmaceutical companies are afraid to '*adentrarse por caminos demasiado innovadores*' ('penetrate along paths that are excessively innovative'). In contrast, researchers' confidence can be boosted by new developments or, as Massagué states, when they know they are not alone:

(87) "Que distintos grupos estén llegando al mismo grupo de genes es una buena noticia porque da confianza de que la investigación va por buen *camino*". (em40)¹³⁰

The only verb in Spanish that was used to signal significant progress is *avanzar*, which could refer to researchers, their research or technological support. The implication was always positive, so that Baselga could describe the change in paradigm to targeted therapy in the following terms:

(88) "Ahora ya no estamos *avanzando* a ciegas; ahora tenemos dianas moleculares para actuar con fármacos específicos". (ep07)¹³¹

In this new context it is important to plan where the research is heading and to have good leadership and this was occasionally expressed in the Spanish texts through maritime metaphors. Thus, the prestigious US oncological institution ASCO is said to *marcar el rumbo* ('set the course') (ep07) and the Spanish National Cancer Research Centre is described as a *buque insignia* 'flagship' (ep06). However, the nautical frame also served to condemn the health administration, the scientific community and pharmaceutical companies, who according to critical voices have placed too much emphasis on basic science and animal models and *han perdido el rumbo* ('have gone off course') (ep06).

¹³⁰ "That different groups are arriving at the same set of genes is good news because it makes us confident that the research is on the right *road*"

¹³¹ "Now we are not *advancing* blindly; now we have molecular targets to act with specific drugs"

Nevertheless, charting the right course could also be expressed by land route metaphors. Thus, contributions from various disciplines at the 11th World Conference on Lung Cancer held in Barcelona in 2005 led the journalist to claim:

(89) La *senda* para la curación del cáncer de pulmón ya está *trazada*. (ep26)¹³²

The Spanish subcorpus also includes three references to *maps*. In addition to the *mapa de nuevas rutas* ('map of new routes') (ep68) from the cancer charity spokesman Lesley Walker cited in the English subcorpus (example 56), another two *map* metaphors were triggered by the completion of the genetic maps of breast and colon cancers, and insights into the role of microRNA in metastasis. Such studies were said to provide the best *mapa de carreteras* ('roadmap') (em24) to defeat the disease, and to indicate the *hoja de ruta* ('roadmap') (ep58) that will finally reveal which signals make a cell become carcinogenic and invade tissues.

In the EXPEDITION scenario, the Spanish texts use both the *frontera* (3) ('frontier') and the *pionero* (8) ('pioneer') images. In the first case, the three instances all placed innovative drugs, such as Glivec and those acting against angiogenesis, at the *frontera* of cancer research or treatment. In the second case, in the Spanish articles it was not only scientists that were portrayed as *pioneros* ('pioneers') (ep70, em23), but also targeted treatments such as trastuzumab (ep21, ep46), specific projects sequencing the genome of different cancers (em51, em30) and innovative therapeutic measures such as prophylactic surgery for hereditary cancers (em30):

(90) Ya se han obtenido "los primeros frutos" de las investigaciones, de modo que ya hay aproximadamente una docena de nuevos fármacos de este tipo que "son los *pioneros* de lo que va a ser un gran menú de nuevos fármacos para combatir tumores en los años y décadas que vienen". (ep21)¹³³

However, in the midst of this optimism looms a threat to the progress of cancer research:

(91) Sin embargo, es posible que toda esta *locomotora* investigadora en cáncer termine por detenerse si, como parece, se cumplen los peores augurios. (ep50)¹³⁴

¹³² The *path* to a cure for lung cancer has now been *charted*.

¹³³ "The first fruits" of the research have already been gathered, so that there are now around a dozen new drugs of this type that "are the *pioneers* of what will be a great menu of new drugs to fight tumours in the years and decades to come".

¹³⁴ However, this cancer research *locomotive* may finally be halted if, as seems likely, the worst predictions are fulfilled.

This was announced by the president of ASCO in reference to the 12% reduction in cancer research funding over the previous four years.

As has been seen throughout this discussion, the representation of the progress of cancer research with the MOVEMENT FORWARDS source domain is for the most part highly conventional or only minimally elaborated. However, there are isolated examples of more creative images.

The Spanish subcorpus includes a longer quotation than the English text (see example 41) of the *NEJM* editorial relating to the man whose melanoma was successfully treated by cloned immune cells. This exploits a desert scenario that augurs a relatively bright future for immunotherapy:

(92) Los datos de esta semana «pueden representar un *espejismo*, un *oasis* o un anticipo del inminente *destino* [...] el tiempo dirá, pero aunque el *destino* no está en nuestra mano, se perfila en el *horizonte*». (em46)¹³⁵

In the same vein, another text resorted to the desert scenario with regard to the change in the approach to cancer represented by personalised medicine:

(93) Después de una *larga travesía del desierto* en el tratamiento del cáncer, “estamos tirando del hilo bueno para desenmarañar la madeja molecular de los tumores”, afirma Ramon Colomer, jefe del servicio de Oncología Médica del Instituto Catalán de Oncología de Girona. (ep08)¹³⁶

In this example the *desierto* (‘desert’) can be seen as the obstacle that has to be overcome. Since deserts are prototypically barren places, a conventional way to describe developments would be through expressions related to fruition and blooming (Kövecses 2010: 128-129), as in the promise of the oasis in the previous example. However, the oncologist chooses a solution that introduces a different metaphorical frame, namely cancer as a *tangle*. Thus, unravelling the tangle provides the solution for the problematic situation (Williams Camus 2009a; 2009b).

This section has analysed the patterns and functions of the metaphorical expressions from the MOVEMENT FORWARDS source domain in the Spanish subcorpus. Although the

¹³⁵ This week’s data “may represent a *mirage*, an *oasis* or announce the imminent *destination* [...] time will tell, but even if the *destination* is not at hand, it is on the *horizon*”.

¹³⁶ After a *long trek across the desert* in cancer treatment, “we are pulling on the right thread to unravel the molecular tangle of tumours,” claims Ramon Colomer, Head of the Department of Medical Oncology at the Catalan Institute of Oncology in Girona.

structure followed is similar to that used in the English subsection, it soon became apparent that the pattern of use in the Spanish texts differed in a number of ways. While the deontological appeal was made with the equivalent lexical metaphors or some broadly similar images, namely *paso* ('step'), *avance* ('advance'), *hito* ('landmark' or 'milestone'), *salto* ('leap'), *obstáculo* ('obstacle') and *barrera* ('barrier'), these were also found in contexts that provided a broad perspective of cancer research and to cover the middle ground lying between scientific discovery and application. This was especially true of *avance*, for which this perspective outnumbered the deontological function by three to one. Moreover, the Spanish subcorpus contained no single reader-attracting metaphor like *breakthrough*, with only three tokens of the most striking image *hito*. There was also a notable absence of graded adjectives with the deontological markers, and a general tendency to downplay the laudatory tone on the part of both scientists and journalists.

Similarly, in view of the virtual absence of the counterparts of *lead* and *pave the way*, the teleological appeal in the Spanish subcorpus was restricted to a series of phraseological units centred on *abrir* ('open') combined with a variety of nouns such as *puerta* ('door'), *avenida* ('avenue'), *camino* ('way' or 'road'), *vía* ('way') and *dirección* ('direction'). The metaphorical expressions realising this function displayed less modality than those in the English subcorpus, which could be related to the fact that they were oriented to a greater extent towards the advance of theoretical knowledge than towards practical applications in diagnosis and treatment.

In covering the distance between scientific discovery and potential goals, the Spanish subcorpus also contained metaphorical expressions based on *cerca* ('close') and *lejos*, ('far off') but there was no clear-cut distinction between the use by journalists and scientific experts. However, journalists also drew on more specific frames within the MOVEMENT FORWARDS source domain such as the EXPEDITION and MARITIME frames. The former, expressed through *frontera* ('frontier') and *pionero* ('pioneer') cast a positive light on the progress of cancer research whereas the nautical associations could be invoked to cast a shadow over such aspects as funding and the attitude of some entities and agencies involved in drug development. Nevertheless, negative evaluation, as in the English texts, was rare.

Overall, there was a tendency for the Spanish writers to focus their articles around scientific events such as international conferences or to highlight a whole series of publications in prestigious journals like *Nature*, although the Spanish subcorpus also contained articles that, like those in the English newspapers, created a news story out of a single scientific event. This trend would account for the broader perspective of the articles and the more varied use of certain linguistic metaphors that were highly restricted in the English texts. It also provides the best framework for Spanish journalists to promote the work of Spanish scientists not only within the national borders but also by situating them in the international context.

10.5 Summary

This chapter has discussed the patterns and functions of metaphorical expressions from the MOVEMENT FORWARDS source domain. Fahnestock's (1986) deontological and teleological appeals, which she relates to the epideictic nature of popularisation articles, served as a starting point to account for the roles of some MOVEMENT FORWARDS metaphors used to evaluate a given scientific event in the present or to project it into the future. It has been argued that the overall effect of the deontological and teleological appeals is that they construct a narrow view of science. However, these two appeals do not encompass all the functions performed by MOVEMENT FORWARDS metaphorical expressions in the corpus, since these are also used to cover the middle ground that stretches between scientific discovery and application, thus playing an important role in managing the expectations raised by the aforementioned appeals.

In the English subcorpus, metaphorical expressions used for deontological purposes were high in number. It has been shown how journalists and scientists managed the force of these metaphors by boosting them through graded adjectives or attenuating them through modality and other hedging devices. In terms of attribution, minor distinctions have been noted. Journalists showed a greater tendency to use the *breakthrough* motif, although this was carefully qualified in some cases. In contrast, scientists preferred to class their developments as graded *steps* and *advances*. The teleological approach was primarily realised by *lead* and metaphorical expressions

related to the notions of preparing roads or starting out on a path. The goals implied by these expressions were mostly of a practical nature and were also couched in tentative language by scientists and experts. The metaphorical expressions covering the middle ground were used strategically by scientists to provide a more realistic appraisal of their achievements, thus compensating for any tendency to overstate the significance of their findings. Although scientists need to promote their research, a degree of cautious excitement is required in order to shield them from adverse criticism from the scientific community or the community at large. However, most of the metaphorical expressions covering the middle ground came from journalists not only to project the immediate effect of the scientific discoveries, but also to convey the eventual benefits to society without arousing false expectations in their readers.

In the Spanish subcorpus, MOVEMENT FORWARDS metaphorical expressions performed a wider range of functions than in the English texts and overall the articles were oriented towards the broad view of science. Thus, whereas in the English subcorpus metaphorical expressions such as *step* and *advance* were used exclusively or primarily with a deontological function, their Spanish counterparts *paso* and *avance* (particularly the plural form of the latter), were predominantly used in a general contextualising role, situating individual studies within the broader view of cancer research and management. When these images realised the deontological appeal, there was a noticeable absence of intensifying adjectives for *paso*, in addition to a tendency to tone down the force of the metaphor.

A marked difference between the subcorpora is the virtual absence of the most direct Spanish equivalents for *lead* ('conducir' and 'llevar'), which dominated the teleological function in English. In the Spanish texts, therefore, the teleological appeal was mostly expressed through various phraseological units with *abrir* ('open') as their nucleus. The verb *abrir* was mostly found in the unmodified present tense so that the projection from the new development or finding and its future application was expressed by journalists and scientists in a more assertive manner. This may be explained by the fact that the implied goals, unlike those in the English texts, were mostly of a theoretical, rather than a practical, nature.

Overall, it could be argued that the focus of the English articles is to convert the scientific development into a newsworthy event, whereas the focus of the Spanish articles is to contextualise scientific advances within the broader perspective in order to boost the prestige of Spanish science and scientists not only at the national level but also within the international research community.

Chapter 11

Conclusions

Es cierto que quedaba un poco en el aire la cuestión sobre la identidad patológica del bulto, pero el bulto era una metáfora, y no había análisis capaz de detectar la malignidad o benignidad de una metáfora.¹³⁷ Juan José Millas, *Ella imagina*.

11.1 Introduction

As outlined in the introductory chapter to this thesis, the aim of this study was to account for relevant metaphorical expressions that are used in the popularisation of cancer advances in the English and Spanish press. The study was motivated by the general controversy surrounding the metaphors of cancer especially in relation to the use of militaristic metaphors. In this final chapter, I discuss the results of this thesis in relation to metaphor studies and popularisation discourse in the realm of the press.

11.2 Summary and conclusions

One of this project's objectives was to carry out a detailed examination of war-related lexis in the corpus of popularisation articles. Although the use of these expressions has generally been strongly criticised, the aim of chapter 6 was to move beyond the debate over the acceptability or unsuitability of martial metaphors and to focus on the actual patterns and functions of the WAR, VIOLENCE AND AGGRESSION metaphorical expressions in the corpus.

¹³⁷ It is true that the question of the pathological identity of the lump remained somewhat in the air, but the lump was a metaphor, and there was no analysis capable of detecting the malignant or benign nature of a metaphor.

Given that one of the overarching metaphors in Western biomedicine is DISEASE IS WAR/INVASION (Goatly 2007: 49), it came as no surprise that military and violent metaphors were numerous and varied. This was especially true for the English subcorpus, which showed a mean metaphor density of 12.14 per 1000 words, which was significantly higher than that of the Spanish subcorpus (7.50; $P < 0.001$). It should be noted that the ten most recurrent metaphorical concepts accounted for 68% of the WVA metaphorical expressions in each of the subcorpora. Of this highly recurrent metaphor set, a minor difference between the two subcorpora involved the preference of the Spanish articles for consolidated metaphorical concepts from scientific discourse whereas the English texts relied more on linguistic metaphors related to violent action.

A closer examination of the distribution of the WVA metaphorical expressions revealed that they are unevenly exploited in the texts. In the articles where these expressions were used more systematically, WVA metaphors were shown to perform a range of important discourse functions either as a single frame of reference or in combination with other metaphorical systems. Thus, in the analyses carried out on text excerpts and the sample texts, which were selected from articles on the basis of their high metaphor density and systematic use of expressions from the WVA source domain, it was shown how these metaphors generally provided texture and coherence to the discourse. Although many of the metaphorical expressions from this domain were of a conventional nature, when it was used to explicate the special properties of new treatments, the richness of the WVA source domain offered ample lexical resources to account for the structure and workings of targeted therapies involving nanotechnology or the use of viral vectors. With the more specific scenarios of guerrilla warfare and battlefield confrontation, journalists and scientists were able to vividly reformulate the general oncological approach to be adopted or to clarify the complex interactions of the biological entities involved at both the cellular and molecular levels. Finally, given the emotive and evocative force of linguistic metaphors such as *weapon-arma* or *war-guerra*, these expressions were exploited in headlines as attention-grabbing devices.

Chapter 7 focused on the metaphorical expressions used to recontextualise metastasis in the press. Marked differences were identified in the analysis of the two subcorpora. In the English texts, the process of metastasis was presented with little metaphorical aid. Nevertheless, the linguistic metaphors from the INVASION AND COLONISATION source

domain were the most recurrent, together with some isolated linguistic metaphors instantiating the MIGRATION source domain, and a single occurrence of the JOURNEY theme. The virtual absence of metaphorical expressions for metastasis in *The Guardian* was particularly striking, and it was suggested that this may be related to the negative connotations associated with colonisation and the British Empire. A slight metaphorical elaboration was appreciated through the personification of biological entities which were vilified and portrayed as participating in delinquent activities in a small number of texts.

In contrast, the metaphorical expressions used to convey the process of metastasis in the Spanish subcorpus were much more prominent. The most recurrent metaphorical systems were those derived from scientific discourse: the INVASION AND COLONISATION and the DISSEMINATION source domains, followed by the JOURNEY and MIGRATION source domains. In the Spanish articles, metaphorical expressions from these four domains were combined in clusters or stretched throughout the texts. Although the use of conventional metaphorical expressions was the norm in the Spanish subcorpus, there was a small number of examples illustrating how in some texts technical metaphors were ‘opened up’ and further elaborated for the benefit of the lay audience. Occasionally, as with the English texts, relevant biological entities were personified and depicted as if involved in felonious activities or displaying immoral behaviour.

Chapter 8 dealt with the metaphorical expressions for another important biological process, apoptosis. Given the concern shown by experts in the field about the potential ambiguities inherent in the mechanistic and anthropological associations of the terms related to apoptosis, a general introduction was provided on the use of metaphorical terms in specialised domains. Analysis of the English and Spanish texts covering the topic of apoptosis revealed that in general terms, creative images were rare and that popular accounts employed linguistic metaphors similar to those encountered in specialised genres. Nevertheless, subtle differences have been found in terms of cross-linguistic variation. Thus, the English texts showed a tendency towards greater use of the suicide image whereas the Spanish texts exhibited greater reliance on the use of phraseological variants based on the noun *muerte* (‘death’). In this chapter, the discussion generally pivoted around the appropriateness of the suicide image since it was pointed out that, in certain contexts, the metaphor may not serve the purpose of

elucidating the process of apoptosis. It was argued that use of the suicide image in the sample text analysis in the English subsection might be justified because the motivation of the metaphor was explained. However, it was shown how, in other contexts, the metaphor might be confusing. Firstly, a suicide is by definition a voluntary act. However, in a number of examples, cells were made to *commit suicide* by different substances or entities, with the causal relation being expressed through verbs of communication, such as *persuade*, or verbs involving coercion, such as *force*. It was proposed that, in these contexts, verbs expressing ‘neutral’ causal relations, such as *make* or *induce*, would be more appropriate, since a forced suicide might more reasonably be classified as a murder. Secondly, given that a suicide is normally seen as a tragic event, it might be difficult to understand why such an act has a beneficial outcome for the organism. Thus, perhaps to simply state that cells ‘die’ could prove less obscure, since, in general, it is easier to understand that when the time comes, living organisms will perish.

The aim in chapter 9 was to explore the metaphorical expressions used to account for cancer treatments. No major differences were noted between the two subcorpora, but a distinction could be drawn between the metaphorical expressions employed to represent conventional cancer therapies and the novel or potential personalised treatments. Three different source domains – WEAPONRY, GARMENTS and FOOD AND COCKTAILS – were employed for the presentation of cancer therapies in the English and Spanish newspapers examined in this study. The WEAPONRY source domain was used to depict both conventional and personalised treatment but the types of arms attributed to each of these therapeutical approaches varied. Conventional treatments – chemotherapy, radiotherapy and surgery – were conveyed through violent images that emphasised their imprecise and destructive nature, such as *blunt instrument* and *bomb dropping*, whereas the portrayal of personalised treatment was carried out through highly accurate and sophisticated weapons. The fairly conventional metaphorical expression of the *magic bullet* occurred in some examples of the corpus to present personalised and novel treatment, but it was contested by some journalists and scientists because a single cure for cancer is now considered an unattainable goal in the context of oncology. Perhaps because the *magic bullet* image is now becoming rather worn, other metaphorical expressions from the GARMENTS and FOOD AND COCKTAILS source domains are emerging to depict new personalised treatments.

In terms of the associations that could arise from the use of expressions from these three source domains, it was argued that the generally violent depiction of conventional therapies could add to the fear and anxiety of some patients. In contrast, the GARMENTS and FOOD AND COCKTAILS source domains, although they may appear less controversial since they are not imbued with violent associations, also present a number of pitfalls. The paradigm of personalised treatment (metaphorically conveyed through *tailored* treatments and *à la carte service*), as desirable as it may be, is unlikely to become readily available in the near future, so that patients will have to cope with the conventional treatments that are portrayed so negatively in the corpus. In addition, the fact that these personalised treatments will only be suitable for small subsets of the population (patients with an appropriate genetic profile), implies that the cost of such therapies will be particularly high.

Chapter 10 focused on the patterns and functions of the MOVEMENT FORWARDS metaphorical expressions that were used to discuss advances in cancer research and management. Instantiations of the MOVEMENT FORWARDS source domain were found to perform three predominant functions: a) realising the deontological appeal, b) realising the teleological appeal, and c) covering the middle ground. In the English subcorpus, linguistic metaphors mostly performed the deontological and teleological functions which helped to recontextualise scientific development into a newsworthy event and generally offered a narrow view of scientific endeavour. In contrast, metaphorical expressions in the Spanish subcorpus were often found to account for the middle ground, positioning Spanish science and scientists within the larger picture of international cancer research, and thus providing a broader view of scientific activity.

Taking the results of the individual empirical chapters together the following observations can be made.

1. The Spanish subcorpus showed a greater tendency towards the use of metaphorical expressions drawn from scientific domains. This was attested in chapter 6, where the most recurrent metaphorical expressions from the WVA source domain consisted predominantly of technical metaphors used in oncology. In addition, in chapter 7, articles discussing metastasis showed a preference for metaphorical expressions from the INVASION AND COLONISATION and the DISSEMINATION source domains, which are

related to Halsted's and Paget's theories on metastasis, respectively. Finally, in chapter 8, it was shown that the Spanish popular accounts of apoptosis relied more heavily on variants of the noun *muerte* ('death'). In contrast, the English subcorpus showed a preference for WVA metaphors containing verbs expressing violent actions; an avoidance of metaphorical representation of metastasis, which was referred to mainly through the non-metaphorical 'spread'; and a tendency to resort to the suicide image for apoptosis.

2. In terms of metaphor use, two notable differences were found between the subcorpora. In chapter 6, it was noted that, in the English subcorpus, the lexical set with the highest frequency in the WVA source domain was *target* (160 instances). The nearest equivalents in the Spanish subcorpus both in terms of frequency and use were – *diana* for the noun and *dirigir* for the verb – which do not have militaristic or violent connotations. Although this difference could largely explain the discrepancy in real numbers (946 vs. 775) between the English and Spanish subcorpora, there would still be a significant difference in the mean metaphor density (approximately 10.25 vs. 7.45 per 1,000 words) because of the greater text length of the Spanish articles.¹³⁸ On the other hand, as noted above the English subcorpus exhibited limited use of metaphorical expressions for metastasis, which was preferably conveyed through 'spread'.

3. The starting point of this study was Sontag's condemnation of militaristic metaphors in the discourse of cancer. Although her impressions have been backed up by other cancer patients and analysts, the results of this study do not support the notion that metaphors are inherently good or bad *per se*.

The analysis of the metaphors used in the popularisation of cancer supports the view that metaphor is a multifunctional phenomenon and that, in this context, metaphorical expressions can present both advantages and disadvantages. Thus, in chapter 6, it was argued that the portrayal of the structure and composition of a nanoparticle as if it were a bomb could prove useful from a pedagogical vantage point but, at the same time, it is evident that this inherently violent metaphorical expression could upset patients who might prefer a less militaristic conceptualisation of the disease. In chapter 8, it was also

¹³⁸ The figure of 10.25 was estimated by calculating the frequency per 1,000 words for *target* ($160/84,507 \times 1,000 = 1.89$) and subtracting from the metaphor density index for the English subcorpus 12.14.

suggested that in certain contexts the suicide image may not serve the purpose of elucidating the process of apoptosis but, on the other hand, can be considered an effective attention-grabbing device, which is an important function in press popularisation articles.

The contextual analysis has also shown that metaphorical expressions are particularly useful in promoting and celebrating the work of scientists. In chapter 9, it was suggested that the use of metaphor in the presentation of future cancer treatments may sometimes oversell the expected outcomes of scientific investigations. In contrast, violent imagery is exploited to further dramatise the already devastating side-effects of conventional therapies. Similarly, in chapter 10, the analysis of MOVEMENT FORWARDS metaphors showed that they played an important role in evaluating the research outcomes and in converting scientific investigations into a newsworthy event through the deontological and teleological appeals. As seen in chapter 3, the dramatisation and hyping up of science is required in the popularisation of science in order to meet the news values that govern journalism. However, although a degree of overstatement may be acceptable, special care should be exercised with regard to the expectations that may be aroused by certain metaphors when popularising scientific advances in the treatment and management of cancer. Thus, it is important for journalists, scientists and other experts to ponder the implications of the metaphors they use in the context of cancer popularisation articles in order to avoid giving a distorted picture of the actual state of affairs in the area of oncological research.

11.3 Limitations and guidelines for future research

As discussed in chapter 5, metaphorical expressions from four source domains had to be left out of the analysis, namely LIGHT, GAMES, TANGLES and DETECTIVE STORIES. More research could be carried out into the metaphorical expressions from these source domains to explore how they relate to the results presented in this study. In addition, personification has been examined in passing in chapters 7 and 8, a more systematic analysis might prove of interest given the pervasiveness of this type of metaphor.

In chapters 7 and 8, it was suggested that the absence of certain metaphorical expressions could be explained from a cultural and ideological perspective. Thus, the absence of metaphorical expressions from the INVASION AND COLONISATION source domain observed for *The Guardian* in chapter 7 might be motivated because the British Empire continues to be a controversial topic within some sections of English society. Similarly, the virtual absence of the suicide image noted for *El Mundo* in chapter 8 could also be seen as an attempt to omit a divisive subject for the benefit of their Catholic readers. Clearly, the data set used in this study does not allow these issues to be explored in detail, but specific corpora could be compiled to investigate these aspects more thoroughly.

In chapter 6 and particularly in chapter 9, the potential negative effects that certain metaphorical expressions could have on the readers and especially cancer patients was discussed. In addition, in chapter 8, it was argued that the suicide metaphor could hinder an adequate understanding of the process of apoptosis. These observations could serve as good starting points for the development of audience reception studies.

11.4 Applications

A number of fields could benefit from the findings of this study. This thesis primarily contributes to the examination of metaphor in actual contexts of use. Although the study of metaphor has been prolific since the ‘cognitive turn’ marked by Ortony’s (1979) *Metaphor and Thought* and Lakoff and Johnson’s (1980) *Metaphors We Live By*, metaphor scholars have pointed out that there is a need for a ‘discourse turn’ in metaphor studies (Cameron and Low 2011: 1). In particular, it provides insight into the research of metaphor as a tool in the recontextualisation of knowledge.

The contrastive nature of this project could also prove useful in the context of translator training. A systematic documentation of the correspondences between the languages for the source domains studied and data in those cases in which the cross-linguistic mappings appear not to work could benefit both trainee and practising translators.

Apart from scholars with a linguistic background, the present thesis could be of interest to other professionals, such as science journalists and health professionals working with cancer patients. The works reviewed in chapter 2 can be seen as evidence of the growing interest in relation to metaphor and cancer in the fields of medical humanities, medical sociology and medical anthropology.

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Appendix A

English subcorpus

The Guardian

Code	Headline	Author	Date
gu01	Volunteer patients recruited to test cancer-busting viruses	James Meikle	04/01/2002
gu02	Scientist calculate an end to brain tumours	guardian.co.uk	23/01/2002
gu03	Gene test hope on breast cancer	Robin McKie	03/02/2002
gu04	Cancer charity backs gene check	James Meek	04/03/2002
gu05	Scientists link another gene to breast cancer families	James Meikle	22/04/2002
gu06	Researchers claim cancer breakthrough	Robin McKie	19/05/2002
gu07	Gene project yields skin cancer breakthrough	James Meek	10/06/2002
gu08	'Magic' pill that may tame the killer cells	James Meek	07/08/2002
gu09	Customised cells combat skin cancer	Robin McKie	23/02/2003
gu10	What does the biotech revolution mean?	Gordon McVie	09/03/2003
gu11	Cold virus rids mice of brain cancer	Tim Radford	07/05/2003
gu12	First 'knockout rats' created	guardian.co.uk	22/05/2003
gu13	Hope in ovarian cancer battle	Tim Radford	23/06/2003
gu14	Shell implants 'burn out' cancer cells	Tim Radford	04/11/2003
gu15	New cancer gene identified	Roxanne Escobales	26/02/2004
gu16	Electrical pulses might zap tumours	guardian.co.uk	18/03/2004
gu17	Ageing secret may yield cancer drug	Sarah Boseley	30/04/2004
gu18	Scientists reveal how vegetables help beat cancer	James Meikle	11/05/2004
gu19	Cancer researchers discover 'holy grail'	Debbie Andalo	09/06/2004
gu20	Genetic clue to lung cancer found	guardian.co.uk	22/06/2004
gu21	Study close to finding prostate cancer gene	guardian.co.uk	18/08/2004
gu22	Scientists find way to 'turn off' cancer	Tim Radford	11/10/2004
gu23	What puts the claws in cancer	guardian.co.uk	28/10/2004
gu24	Carrots may help fight against cancer	Tim Radford	09/02/2005
gu25	Cancer-linked genes identified	James Meikle	04/08/2005
gu26	Mutant breast cancer gene puts men at risk	James Meikle	01/09/2005
gu27	Faulty genes combine to increase family cancer risk	James Meikle	28/10/2005
gu28	Food may be new weapon to beat cancer and schizophrenia	Alok Jha	17/11/2005
gu29	Broccoli, cabbage, cauliflower: the vegetables that may prevent cancer	Ian Sample	08/02/2006
gu30	Two-drug therapy may slow breast cancer advance	Polly Curtis	23/03/2006
gu31	Ginger raises new hope in fight against ovarian cancer	Polly Curtis	18/04/2006
gu32	Successful tests boost hope for cancer vaccine	Ian Sample	23/05/2006
gu33	Cancer hope as vaccine trials start	Jo Revill	27/08/2006
gu34	Scientists find molecule that tricks cancer cells into dying	Alok Jha	28/08/2006
gu35	'Good' bacteria may help stop some cancers, say scientists	Ian Sample	07/10/2006
gu36	Vitamin D may help to curb breast cancer, say scientists	Sarah Boseley	17/10/2006
gu37	Researchers use body's immune system to fight skin cancer	Alok Jha	10/11/2006
gu38	Abortion drug can prevent breast tumours, says study	Ian Sample	01/12/2006

gu39	Scientists find genetic key to some breast cancers	Polly Curtis	04/12/2006
gu40	Common cold virus may be new weapon to fight cancer	Alok Jha	11/01/2007
gu41	Genome study finds 100 new cancer genes	Alok Jha	08/03/2007
gu42	Gene find raises hope for gentler, highly effective cancer treatments	Lee Glendinning	12/04/2007
gu43	Star Trek-type scanner could spot cancer	Ian Sample	22/05/2007
gu44	Gene may help to identify inherited breast cancer cases	Alok Jha	25/05/2007
gu45	New breast cancer genes identified	Polly Curtis	28/05/2007
gu46	Breast drug provides ovarian cancer breakthrough	Polly Curtis	15/06/2007
gu47	Coffee and plenty of exercise could cut risk of skin cancer	Ian Sample	31/07/2007
gu48	Forget eating your greens: red and blue foods are the cancer fighters	Ian Sample	20/08/2007
gu49	Cold virus may be used in fight against cancer	James Randerson	04/10/2007
gu50	New therapy targets cancers, not healthy tissues	Ian Sample	30/10/2007
gu51	3-D technique boosts hunt for breast cancer	James Randerson	29/11/2007
gu52	Child gets leukaemia after gene therapy	Sarah Boseley	19/12/2007
gu53	New light shed on how cancers spread	Alok Jha	28/12/2007
gu54	Olivia and Isabella: the identical twins who helped unravel secrets of leukaemia	Ian Sample	18/01/2008
gu55	Genetic test in three years to detect prostate cancer	Ian Sample	11/02/2008
gu56	'Suicide protein' could help treat melanomas	Alok Jha	08/02/2008
gu57	Fasting could ease effects of chemotherapy	Alok Jha	01/04/2008
gu58	Genetic variants increase smokers' risk of lung cancer	Alok Jha	02/04/2008
gu59	Can microwaves help us to beat breast cancer?	Michael Pollitt	03/04/2008
gu60	Height genes may provide clues to cure for cancer	Alok Jha	07/04/2008
gu61	New drug can protect healthy cells during radiotherapy	Alok Jha	11/04/2008
gu62	Scientists solve riddle of arsenic cancer treatment	Alok Jha	14/04/2008
gu63	Magnets can guide anti-cancer drugs to tumours, say scientists	Alok Jha	17/04/2008
gu64	Cloned immune cells cleared patient's cancer	Ian Sample	19/06/2008
gu65	Immune to disappointment	Ian Sample	19/06/2008
gu66	Drug trial hope for men with prostate cancer	Sarah Boseley	21/07/2008
gu67	The new cancer trial that offers hope to thousands	Denis Campbell	10/08/2008
gu68	Prostate cancer test set to transform treatment	Ian Sample	11/02/2009
gu69	US researchers detect pancreatic cancer before its growth	guardian.co.uk	23/02/2009
gu70	Drug trial gives hope of longer life to women fighting ovarian cancer	Denis Campbell	07/04/2009
gu71	Scientists on brink of cancer treatment revolution	Robin McKie	04/10/2009
gu72	Scientists find gene that stops some cancers in their tracks	Ian Sample	05/10/2009
gu73	Scientists prove cancer can be passed on in the womb	Sarah Boseley	12/10/2009
gu74	First cancer genome sequences reveal how mutations lead to disease	Ian Sample	16/12/2009
gu75	Scientists find way to judge severity of prostate cancer	Sarah Boseley	23/09/2009

The Times

Code	Headline	Author	Date
ti01	Cancer has a barcode	Anjana Ahuja	04/03/2002
ti02	Molecule find helps the battle against cancer	Helen Studd	06/08/2002
ti03	Magic bullets may be too good to use	Nigel Hawkes	11/09/2002
ti04	Target: killers in the cells	Simon Crompton	18/03/2003
ti05	Common cold virus deadly to brain tumours	Nigel Hawkes	07/05/2003
ti06	'Smart' cancer drug cuts misery of side-effects	Oliver Wright	28/05/2003
ti07	Scientists discover how to switch on anti-cancer gene	Nigel Hawkes	23/06/2003
ti08	'Pied Piper' clue to cancer spread	Nigel Hawkes	02/09/2003
ti09	Medicine on target: new cancer hopes	Jerome Burne	09/09/2003
ti10	Cancer treatment kills cells one by one	Mark Henderson	02/12/2003
ti11	Does chemo benefit all?	Jerome Burne	06/01/2004
ti12	First cancer drug to starve tumours on way next year	Nigel Hawkes	28/02/2004
ti13	A very, very small step to beating the Big C	Mark Henderson	29/04/2004
ti14	The bitter truth – why greens are good for us	Nigel Hawkes	11/05/2004
ti15	Hunter virus gives new hope on cancer	Jonathan Leake	30/05/2004
ti16	Gene hope for breast cancer	Nigel Hawkes	28/06/2004
ti17	Broccoli plus tomato staves off cancer	Jonathon Carr-Brown	18/07/2004
ti18	Prostate progress	Thomas Stuttaford	07/10/2004
ti19	Apple a day keeps cancer away	Nigel Hawkes	19/10/2004
ti20	Drug giants pin hopes on 'tadpole' to fight cancer	Richard Irving	05/02/2005
ti21	Cell discovery could put cancer to sleep	Nigel Hawkes	16/03/2005
ti22	Old enemy, new hope	Thomas Stuttaford	17/03/2005
ti23	Dublin scientists develop drug that kills cancer cells	Dearbhail McDonald	27/03/2005
ti24	Drug fights breast cancer gene	Mark Henderson	14/04/2005
ti25	Breast cancer: a drug right on target	Thomas Stuttaford	19/05/2005
ti26	Plant therapy offers prostate cancer cure	Jonathan Leake	29/05/2005
ti27	What makes cancer spread?	Anjana Ahuja	11/07/2005
ti28	Scientists find key to stop spread of breast disease	Mark Henderson	28/07/2005
ti29	Cancer drug 'smart cell' can attack tumours from inside	Mark Henderson	28/07/2005
ti30	Prostate cancer: the clue to its origins?	William Little	02/12/2005
ti31	Scientists discover clue to growing new breast tissue	Mark Henderson	05/01/2006
ti32	Ark breaks new ground in tackling cancer care side-effects	Richard Irving	20/02/2006
ti33	Drug that opens a new front in the battle against breast cancer	Sam Lister	23/03/2006
ti34	Lung cancer drug may fight breast tumour in women	Mark Henderson	01/05/2006
ti35	Stomach cancer gene identified	Sean Duke	07/05/2006
ti36	Turn me on, turn me off: a new genetic way to tackle cancer?	Jerome Burne	12/05/2006
ti37	Britain gets cancer 'wonder' drug	Nigel Hawkes	31/07/2006
ti38	Reasons why this one may be different	Nigel Hawkes	31/07/2006
ti39	Two lives saved by white blood cells turned into cancer hunters	Mark Henderson	01/09/2006
ti40	Cure for cancer born from the horrors of Ypres	Nigel Hawkes	08/11/2006
ti41	Scientists find key to treating skin cancer	Nigel Hawkes	21/12/2006
ti42	How to fight a disease that often fights back	John Naish	10/02/2007

ti43	How radio and chemotherapy work	John Naish	10/02/2007
ti44	Research to benefit patients, not doctors	John Naish	10/02/2007
ti45	Back to the start of it all	John Naish	10/02/2007
ti46	Scientists find key to kinder cancer drugs	Mark Henderson	12/04/2007
ti47	Immune cells from resistant donors 'may be cure for cancer'	Yepoka Yeebo	20/09/2007
ti48	Single gene linked to many cancers	David Rose	24/09/2007
ti49	'Magic bullet' devised to beat cancer	Nigel Hawkes	30/10/2007
ti50	Scientists join forces in new war on cancer	Melaine Reid	26/11/2007
ti51	Twin girls lead scientists to secret of childhood cancer	Mark Henderson	18/01/2008
ti52	New drug Lapatinib shrinks breast cancer	Nigel Hawkes	18/04/2008
ti53	It's all in the genes	Mark Henderson	03/05/2008
ti54	Cancer stem cells give clues to tumour regrowth	Jenny Knight	10/05/2008
ti55	Cancer 'breakthrough' in cloning treatment	Jack Malvern	19/06/2008
ti56	Cancer drug could save the lives of 10,000 a year	David Rose	22/07/2008
ti57	Once they were beyond hope. Now science could halt the domino effect	Mark Henderson	22/07/2008
ti58	New trial using doxorubicin and brittle bone drug, bisphosphonate drug zoledronic acid, gives breast cancer hope	David Rose	13/08/2008
ti59	Drug made from everyday virus helps fight cancers	David Rose	16/12/2008
ti60	How mix-and-match cancer therapies will 'personalise' drugs to attack tumours	Mark Henderson	23/12/2008
ti61	Survival tactic for cancer cells	Chris Smyth	05/01/2009
ti62	New drug olaparib offers hope to women with genetic breast cancer	David Rose	01/06/2009
ti63	Bee venom destroys cancer cells in tests on mice	Hannah Devlin	11/08/2009
ti64	Salinomycin drug may prevent breast cancer returning	Mark Henderson	13/08/2009
ti65	Breast tumour drug could treat many skin cancer cases	Mark Henderson	31/08/2009
ti66	Scientists hail key breast cancer gene advance	David Rose	05/10/2009
ti67	Tumours could be 'cooked' with magnetic particles	Hannah Devlin	06/10/2009
ti68	Mix 'n' match therapy targets cancers faster, Drug-effect directory could save thousands of lives	David Rose	06/10/2009
ti69	Understanding DNA defects is route to better cancer therapy	Hannah Devlin	06/10/2009
ti70	Changes found in cancer cells could help to target treatment	Mark Henderson	04/11/2009
ti71	Nanoparticle cancer therapy targets tumours and dodges immune system	Melaine Reid	05/11/2009
ti72	Cancer care take giant step forward; Scientists unlock code that promises personalized treatment for every patient	Mark Henderson	17/12/2009
ti73	Cracking code for mutations	Mark Henderson	17/12/2009
ti74	Cancer genomics offers hope of targeted drugs, but NHS must prepare to pay	Mark Henderson	17/12/2009
ti75	The killer decoded	Mark Henderson	20/12/2009

Spanish subcorpus

El País

Code	Headline	Author	Date
ep01	“El cáncer es un depredador que aparece como resultado inevitable de la evolución”	Mayka Sánchez	28/01/2003
ep02	La radioterapia de intensidad modulada, un “traje a medida” para cada cáncer	Joaquín Mayordomo	25/02/2003
ep03	El grupo del científico Joan Massagué descubre una ‘diana’ contra el cáncer	Xavier Pujol Gebellí	16/04/2004
ep04	Massagué augura un “torrente” de terapias más efectivas e individualizadas	Xavier Pujol Gebellí	17/04/2004
ep05	Un centro de Barcelona lidera los ensayos de nuevos fármacos contra el cáncer	Xavier Pujol Gebellí	17/04/2004
ep06	Cáncer, ¿una guerra perdida?	Lola Galán	06/06/2004
ep07	“Éste es el principio del fin del cáncer”	Gonzalo Casino	15/06/2004
ep08	Los tratamientos contra dianas moleculares son la gran esperanza	Gonzalo Casino	15/06/2004
ep09	“El diálogo entre células sanas y tumorales es básico en la aparición de un cáncer”	Xavier Pujol Gebellí	06/07/2004
ep10	Los investigadores descubren células madre en varios tipos de cáncer		12/08/2004
ep11	Un principio activo del ‘cannabis’ impide el riego sanguíneo de tumores	Emilio de Benito	17/08/2004
ep12	La inactivación de un solo gen convierte tumores hepáticos en hígado sano	Javier Sampedro	12/10/2004
ep13	“El cáncer de mama dejará de ser causa de muerte y lo vamos a ver nosotros”	Milagros P. Oliva	19/10/2004
ep14	Una vacuna ayuda a frenar los tumores de pulmón	Emilio de Benito	02/11/2004
ep15	Un investigador español crea un ‘superratón’ transgénico resistente al cáncer	Agencias	02/11/2004
ep16	Un grupo español crea un nuevo ‘super-ratón’ resistente al cáncer	Javier Sampedro	03/11/2004
ep17	Un nuevo fármaco frena el mieloma en el 35% de pacientes desahuciados	Emilio de Benito	19/02/2005
ep18	Un grupo de científicos españoles identifica una molécula que permite la expansión del cáncer	Agencias	08/03/2005
ep19	Científicos españoles hallan una molécula que facilita la expansión del cáncer	Mayka Sánchez	09/03/2005
ep20	Un estudio español revela una nueva vía en el origen de los tumores cancerosos	Europa Press	14/03/2005
ep21	Un experto dice que faltan “bastantes años” para sustituir la quimioterapia por antitumorales	OTR Press	28/03/2005
ep22	Oncólogos españoles inaguran la terapia ‘individualizada’ del cáncer de pulmón	Gonzalo Casino	24/05/2005
ep23	Años de aceleración contra el cáncer	Gonzalo Casino	24/05/2005
ep24	Un grupo español prueba con éxito una nueva terapia en un paciente de cáncer	Javier Sampedro	31/05/2005
ep25	Creada una nanopartícula que multiplica por diez el efecto de la quimioterapia	Javier Sampedro	16/06/2005
ep26	Nueva era en el cáncer de pulmón	Rafael Rosell	12/07/2005

ep27	Identificados los genes que provocan metástasis tras un cáncer de mama	Xavier Pujol Gebellí	28/07/2005
ep28	Nanotecnología contra el cáncer	BBC mundo	03/08/2005
ep29	Científicos británicos identifican cuatro genes responsables del cáncer de mama	EFE londres	04/08/2005
ep30	'Educar' al cuerpo para que ataque el origen del tumor	Emilio de Benito	08/10/2005
ep31	"En poco tiempo podremos conseguir que el cáncer no mate al enfermo"	Mayka Sánchez	06/12/2005
ep32	Las infecciones pueden ser un factor clave en la aparición del cáncer infantil		20/12/05
ep33	Una científica española halla el nexo entre las causas del cáncer	Javier Sampedro	26/01/2006
ep34	Los genes del cáncer muestran sus secretos	Gina Kolata	21/02/2006
ep35	Científicos españoles descubren cómo un gen regula el 25% de los tumores de colon, útero y estómago	Emilio de Benito	18/04/2006
ep36	Nanotecnología contra el cáncer	Ester Riu	23/05/2006
ep37	Superratón anticáncer	Jorge Laborda	19/07/2006
ep38	La mutación de un determinado gen puede triplicar el riesgo de cáncer de mama	EFE	01/08/2006
ep39	Un ensayo de terapia génica para el cáncer es eficaz en dos de 17 casos		22/04/2006
ep40	El genoma del cáncer de colon y mama	Javier Sampedro	08/09/2006
ep41	Un nuevo enfoque para el cáncer	M. C. B.	21/09/2006
ep42	Nuevos estudios relacionan algunos virus con el cáncer	Mayka Sánchez	24/10/2006
ep43	Dos avances contra el cáncer	Javier Sampedro	17/01/2007
ep44	Nuevas armas contra el cáncer de mama	Mayka Sánchez	23/01/2007
ep45	Hallada una clave de la resistencia del cáncer a la quimioterapia	Joan Carles Ambrojo	27/02/2007
ep46	La respuesta está en los genes	María Morgado	10/03/2007
ep47	Objetivo: anular los poderes de las células cancerosas	Xavier Pujol Gebellí	12/04/2007
ep48	Una entre millones	Xavier Pujol Gebellí	12/04/2007
ep49	El científico Joan Massagué descubre la clave de la metástasis de cáncer al pulmón	Xavier Pujol Gebellí	12/04/2007
ep50	Compás de espera frente al cáncer	Rafael Pérez Ybarra	12/06/2007
ep51	Moléculas artificiales para bloquear la metástasis del cáncer	June Fernández	15/07/07
ep52	Una molécula para que el cáncer se 'suicide'	Mónica L. Ferraldo	21/07/2007
ep53	Un tipo de células madre extiende el cáncer de mama	Mónica Salomone	04/10/2007
ep54	Descubierto un proceso clave en la aparición del cáncer de colon		01/10/2007
ep55	En busca de una teoría del cáncer	Mónica Salomone	10/10/2007
Ep56	"El 90% del proceso tumoral ocurre sin que nos demos cuenta"	Mayka Sánchez	
ep57	Massagué abre una vía para frenar la metástasis del cáncer de mama	Agencias	10/01/2008
ep58	"La metástasis ya no nos asusta"	Mónica López	15/01/2008
ep59	Un nuevo gen para frenar el cáncer	Ester Riu	26/02/2008
ep60	Un gen 'mafioso' controla al menos otros 1.000 genes en el cáncer de mama	Malen Ruiz de Elvira	13/03/2008
ep61	Un búnker contra el cáncer	Sonia Vizoso	25/03/2008

ep62	Massagué identifica cómo las células del cáncer de mama se expanden al pulmón	EFE	03/04/2008
ep63	Massagué identifica dianas terapéuticas para frenar las metástasis de cáncer de mama al pulmón		03/04/2008
ep64	Massagué identifica nuevas dianas para frenar la metástasis	Mónica López	04/04/2008
ep65	La ingeniería aporta nuevas vías contra el cáncer	Ester Riu	10/06/2008
ep66	La lucha contra el cáncer, una guerra de guerrillas		05/09/2008
ep67	Gaiker coordina un proyecto europeo para usar nanopartículas contra el cáncer	June Rernández	22/10/2008
ep68	Identificado el mecanismo que permite a las células sobrevivir a la quimioterapia	EFE	05/01/2009
ep69	Hallado el gen que ayuda al cáncer a entrar en el cerebro	Alicia Rivera	07/05/2009
ep70	El estudio de una proteína abre esperanzas contra la metástasis	Malen Ruiz de Elvira	23/06/2009
ep71	Una terapia destruye los melanomas “desde dentro”	Emilio de Benito	04/08/2009
ep72	Las células madre abren un nuevo flanco en la investigación del cáncer	Javier Sampedro	10/08/2009
ep73	Ataque español al melanoma	Emilio de Benito	24/08/2009
ep74	Descrita una molécula que regula genes del cáncer	M. L. F.	08/09/2009
ep75	El cáncer que no duerme	Joan Carles Ambrojo	29/10/2009

El Mundo

Code	Headline	Author	Date
em01	Nuevas fórmulas de administrar fármacos contra el cáncer	elmundosalud.com	20/09/2004
em02	EEUU impulsa la nanotecnología para vencer al cáncer	Javier Barbado	27/09/2004
em03	Probada la utilidad de un fármaco contra el cáncer avanzado de próstata	Javier Marco	07/10/2004
em04	Un estudio en ratones logra inactivar un gen vinculado al cáncer	María Valerio	13/10/2004
em05	Descubierto un gen clave en la formación de tumores	María Valerio	08/02/2005
em06	Las incertidumbres del cáncer de próstata	María Valerio	05/03/2005
em07	Científicos españoles identifican una proteína que permite la extensión del cáncer	María Valerio	08/03/2005
em08	Identificado un nuevo tipo de genes de «segunda fila» que causan cáncer familiar	Isabel Perancho	23/04/2005
em09	Quimioterapia ‘personalizada’ también para el cáncer de pulmón	Europa Press	19/05/2005
em10	Un nuevo paso hacia la raíz génica del cáncer	María Valerio	09/06/2005
em11	Descritos los genes de la expansión del cáncer de mama a los pulmones	María Valerio	27/07/2005
em12	La nanotecnología se incorpora al tratamiento del cáncer	Javier Marco	05/08/2005
em13	Descrito un mecanismo natural para frenar el proceso tumoral	María Valerio	03/08/2005
em14	Identificado un nuevo factor para el pronóstico del cáncer de mama	Ángeles López	25/08/2005

em15	Cómo detectar el cáncer con anticuerpos del propio organismo	Javier Marco	21/09/2005
em16	Nanoterapia contra el cáncer	María Valerio	04/11/2005
em17	Epigénica, más allá de la genética	María Valerio	08/02/2006
em18	Descubierta una molécula vinculada a la expansión del cáncer a los huesos	María Valerio	30/03/2006
em19	Un retrovirus puede actuar como cofactor del cáncer prostático	Isabel Perancho	01/04/2006
em20	Investigadores españoles describen qué papel juega el 'gen del envejecimiento' en el cáncer	María Valerio	22/05/2006
em21	Cócteles moleculares para sustituir a la quimioterapia	María Valerio	10/06/2006
em22	El ganglio «centinela» del cáncer de colon	Patricia Matey	24/06/2006
em23	Un nuevo método de terapia génica consigue destruir células tumorales de melanoma	María Valerio	31/08/2006
em24	El mapa del cáncer de colon y de mama desvela 200 genes con funciones clave	María Valerio	08/09/2006
em25	Cinco genes predicen la mala evolución del cáncer de pulmón	Isabel Espiño	03/01/2007
em26	Dos estudios en ratones logran modular un gen clave para frenar el crecimiento tumoral	María Valerio	24/01/2007
em27	Las células madre del cáncer	Eva Hernando	05/03/2007
em28	Un paso más hacia el 'genoma del cáncer'	María Valerio	26/03/2007
em29	Una investigación española profundiza en la raíz de la metástasis del cáncer de mama	María Valerio	11/04/2007
em30	Identificados cuatro nuevos genes que aumentan el riesgo de cáncer de mama	Elmundo.es	28/05/2007
em31	El galimatías del cáncer de mama hereditario	María Valerio	21/06/2007
em32	Un gen protector contra el cáncer, clave para retrasar el envejecimiento	María Valerio	18/07/2007
em33	Un virus del resfriado contra un agresivo cáncer del cerebro	María Valerio	21/09/2007
em34	El cáncer podría tener el mismo origen metabólico que la obesidad y la diabetes	María Valerio	24/10/2007
em35	El cáncer en el árbol genealógico	María Valerio	14/11/2007
em36	Descubren cómo las mutaciones genéticas provocan cáncer de mama hereditario	María Valerio	10/12/2007
em37	Un microchip permite 'cazar' células cancerosas en un test sanguíneo	María Valerio	21/12/2007
em38	Terapias selectivas	María Valerio	29/12/2007
em39	Una investigación logra frenar las metástasis del cáncer de mama en tejidos humanos	María Valerio	11/01/2007
em40	El 'jefe del crimen' se llama SATB1	María Valerio	12/03/2007
em41	Ayuno frente al cáncer	Isabel Espiño	01/04/2008
em42	El cáncer de mama se aprovecha de una hormona 'buena' para expandirse	María Valerio	03/04/2008
em43	Transforman células de la piel en células madre del cáncer	María Valerio	11/04/2008
em44	Un nuevo fármaco dirigido al núcleo duro del cáncer de mama	María Valerio	18/04/2008
em45	Células inmunes de un paciente con melanoma eliminan todo rastro de su propio cáncer	Ángeles López	19/06/2008
em46	Autovacunas de diseño para matar al cáncer	Alejandra Rodríguez	21/06/2008

em47	Un chip 'atrapa células' evalúa la respuesta del cáncer de pulmón durante el tratamiento:	María Valerio	03/07/2008
em48	El gen Myc demuestra sus posibilidades como diana de tratamientos contra el cáncer	Efe elmundo.es	17/08/2008
em49	Descifrados los mapas genéticos de los dos cánceres más mortales	Cristina de Martos	04/09/2008
em50	Descubierto un nuevo gen responsable del cáncer de colon	María Valerio	15/09/2008
em51	Descifrando el genoma del cáncer de pulmón	María Valerio	22/10/2008
em52	Secuencian por primera vez el genoma del cáncer de un individuo	María Valerio	05/11/2008
em53	El ovillo del cáncer se enreda	María Valerio	09/11/2008
em54	Un análisis de sangre podría ayudar a diagnosticar un agresivo tumor cerebral	María Valerio	16/11/2008
em55	Los genes culpables de la metástasis	Víctor Cordoba	27/12/2008
em56	El 'séptimo jinete' del cáncer	Ángeles López	02/01/2009
em57	Los virus del cáncer se 'burlan' de las defensas del sistema inmune	María Valerio	10/02/2009
em58	Nanopartículas fluorescentes para localizar y combatir el cáncer	Miguel G. Corral	24/02/2009
em59	¿Cómo matar de hambre al tumor?	María Valerio	11/03/2009
em60	Nuevos genes candidatos en el complejo puzzle del cáncer de mama	María Valerio	29/03/2009
em61	Marihuana contra las células cancerosas	María Valerio	02/04/2009
em62	Metástasis del cáncer de mama: cómo se regula el paso al cerebro	María Valerio	07/05/2009
em63	Fármacos ya conocidos funcionan para frenar las metástasis del cáncer	María Valerio	17/06/2009
em64	Dos trabajos en 'Nature' aportan pistas sobre los tumores más frecuentes en los niños	María Valerio	18/06/2009
em65	Nace una nueva familia de fármacos contra el cáncer de mama	María Valerio	25/06/2009
em66	Buscando las 'tildes' mal puestas al cáncer	María Valerio	05/07/2009
em67	Científicos españoles logran que las células del melanoma se 'autodevoren'	María Valerio	03/08/2009
em68	La UIB descubre un nuevo fármaco contra el cáncer		04/08/2009
em69	'Hay que ir hacia una terapia personalizada contra el cáncer'	Miguel Pradas	04/08/2009
em70	Cinco estudios hallan el vínculo que relaciona las células madre con el cáncer	Cristina de Martos	10/08/2009
em71	En busca del 'talón de Aquiles' del melanoma	María Sánchez-Monge	31/08/2009
em72	EGFR, el «apellido» del cáncer de pulmón a partir de ahora	María Valerio	03/09/2009
em73	Un virus podría estar relacionado con el cáncer de próstata	Cristina G. Lucio	08/09/2009
em74	Identificada una segunda proteína que favorece la metástasis del cáncer de mama	Alejandra Rodríguez	08/09/2009
em75	Una molécula abre una nueva vía para el tratamiento del cáncer	Cristina de Martos	12/11/2009

Appendix B

Table B.1 English subcorpus data relating to WAR, VIOLENCE AND AGGRESSION metaphors and metaphor density

Text	<i>The Guardian</i>			<i>The Times</i>			Text	<i>The Guardian</i>			<i>The Times</i>		
	Words	Mets	Index	Words	Mets	Index		Words	Mets	Index	Words	Mets	Index
01	313	11	35.1	1035	0	0	39	792	7	8.8	545	5	9.2
02	391	6	15.3	322	2	6.2	40	741	21	28.3	455	9	19.8
03	555	3	5.4	281	4	14.2	41	549	0	0	472	7	14.8
04	395	0	0	1072	11	10.3	42	571	9	15.8	827	24	29.0
05	451	0	0	493	10	20.3	43	296	0	.0	484	10	20.7
06	472	9	19.1	507	4	7.9	44	470	1	2.1	724	6	8.3
07	644	2	3.1	642	4	6.2	45	627	1	1.6	739	2	2.7
08	1629	9	5.5	235	2	8.5	46	478	4	8.4	589	11	18.7
09	557	8	14.4	521	5	9.6	47	441	2	4.5	348	9	25.9
10	2012	12	6.0	152	8	52.6	48	635	6	9.4	627	2	3.2
11	483	11	22.8	617	2	3.2	49	528	13	24.6	765	24	31.4
12	268	1	3.7	584	5	8.6	50	698	15	21.5	647	9	13.9
13	607	5	8.2	855	13	15.2	51	263	0	0	989	10	10.1
14	244	10	41.0	642	3	4.7	52	362	0	0	423	5	11.8
15	414	4	9.7	420	7	16.7	53	356	0	0	641	8	12.5
16	300	6	20.0	196	2	10.2	54	1004	9	9.0	364	9	24.7
17	352	3	8.5	253	4	15.8	55	636	1	1.6	423	4	9.5
18	265	4	15.1	512	1	2.0	56	328	2	6.1	791	8	10.1
19	456	6	13.2	258	2	7.8	57	269	6	22.3	797	10	12.5
20	507	6	11.8	439	8	18.2	58	798	1	1.3	326	3	9.2
21	410	4	9.8	394	5	12.7	59	405	3	7.4	548	8	14.6
22	572	12	21.0	805	7	8.7	60	469	0	0	777	2	2.6
23	167	5	29.9	392	8	20.4	61	422	6	14.2	209	2	9.6
24	328	5	15.2	494	11	22.3	62	394	5	12.7	879	8	9.1
25	244	4	16.4	907	17	18.7	63	327	8	24.5	590	17	28.8
26	567	0	0	628	6	9.6	64	502	10	19.9	638	16	25.1
27	485	1	2.1	364	7	19.2	65	521	10	19.2	665	5	7.5
28	483	7	14.5	429	4	9.3	66	668	3	4.5	671	8	11.9
29	589	1	1.7	587	17	29.0	67	2264	15	6.6	487	9	18.5
30	649	6	9.2	646	8	12.4	68	558	3	5.4	929	5	5.4
31	388	9	23.2	562	7	12.5	69	646	2	3.1	549	1	1.8
32	442	8	18.1	380	3	7.9	70	853	7	8.2	702	1	1.4
33	779	9	11.6	851	16	18.8	71	543	5	9.2	1010	20	19.8
34	461	3	6.5	416	4	9.6	72	558	6	10.8	660	4	6.1
35	469	4	8.5	486	4	8.2	73	628	3	4.8	424	1	2.4
36	438	1	2.3	843	0	0	74	727	1	1.4	529	10	18.9
37	416	10	24.0	660	6	9.1	75	535	15	28.0	555	6	10.8
38	446	6	13.5	319	10	31.3							

Mets = metaphors

Table B.2 Spanish subcorpus data relating to WAR, VIOLENCE AND AGGRESSION metaphors and metaphor density

Text	<i>El País</i>			<i>El Mundo</i>			Text	<i>El País</i>			<i>El Mundo</i>		
	Words	Mets	Index	Words	Mets	Index		Words	Mets	Index	Words	Mets	Index
01	1111	3	2.7	410	4	9.8	39	206	3	14.6	792	3	3.8
02	1017	3	2.9	431	5	11.6	40	774	6	7.8	834	10	12.0
03	761	3	3.9	620	2	3.2	41	573	7	12.2	805	7	8.7
04	378	5	13.2	516	2	3.9	42	329	7	21.3	700	7	10.0
05	664	1	1.5	719	7	9.7	43	655	4	6.1	542	1	1.8
06	2713	23	8.5	1210	11	9.1	44	1111	6	5.4	830	4	4.8
07	561	1	1.8	496	8	16.1	45	606	9	14.9	1036	15	14.5
08	334	1	3.0	789	3	3.8	46	687	2	2.9	2447	38	15.5
09	704	5	7.1	629	1	1.6	47	313	5	16.0	864	5	5.8
10	449	3	6.7	841	3	3.6	48	233	2	8.6	399	5	12.5
11	526	2	3.8	558	5	9.0	49	810	5	6.2	809	3	3.7
12	704	5	7.1	581	12	20.7	50	1433	8	5.6	463	1	2.2
13	1069	14	13.1	911	6	6.6	51	773	4	5.2	868	2	2.3
14	458	5	10.9	863	1	1.2	52	505	4	7.9	991	1	1.0
15	325	5	15.4	639	5	7.8	53	399	4	10.0	581	3	5.2
16	598	8	13.4	392	1	2.6	54	444	4	9.0	625	5	8.0
17	1015	5	4.9	1326	5	3.8	55	1362	12	8.8	558	2	3.6
18	507	8	15.8	645	4	6.2	56	1141	4	3.5	741	4	5.4
19	264	3	11.4	598	2	3.3	57	368	5	13.6	559	7	12.5
20	558	0	0	639	2	3.1	58	831	10	12.0	670	3	4.5
21	473	8	16.9	1290	13	10.1	59	1055	15	14.2	696	3	4.3
22	340	1	2.9	494	1	2.0	60	448	5	11.2	784	0	0
23	1450	4	2.8	649	10	15.4	61	937	14	14.9	708	2	2.8
24	778	3	3.9	639	2	3.1	62	532	3	5.6	565	1	1.8
25	668	4	6.0	744	3	4.0	63	355	6	16.9	684	3	4.4
26	1656	8	4.8	1247	9	7.2	64	392	3	7.7	677	4	5.9
27	1156	8	6.9	1353	3	2.2	65	809	4	4.9	738	2	2.7
28	496	11	22.2	1035	0	0	66	505	16	31.7	997	3	3.0
29	286	1	3.5	686	1	1.5	67	866	5	5.8	616	5	8.1
30	315	5	15.9	860	0	0	68	451	4	8.9	309	3	9.7
31	653	0	0	789	0	0	69	312	1	3.2	327	8	24.5
32	602	1	1.7	492	4	8.1	70	1031	7	6.8	867	3	3.5
33	638	3	4.7	633	12	19.0	71	598	10	16.7	547	5	9.1
34	1805	13	7.2	625	1	1.6	72	973	4	4.1	810	1	1.2
35	498	2	4.0	955	1	1.0	73	1250	11	8.8	541	1	1.8
36	761	8	10.5	676	6	8.9	74	371	0	0	660	9	13.6
37	758	23	30.3	1016	2	2.0	75	365	2	5.5	825	2	2.4
38	275	1	3.6	1243	5	4.0							

Mets = metaphors

Table B.3 WAR, VIOLENCE AND AGGRESSION metaphorical expressions in the English subcorpus

	<i>Guardian</i>	<i>Times</i>	Total		<i>Guardian</i>	<i>Times</i>	Total
Achilles' heel	2	4	6	*harm*	10	4	14
Aggressive	31	22	53	Hijack	1	0	1
Aim at	4	0	4	Hit	1	5	6
Armed	1	0	1	Home in on	2	2	4
Army	2	0	2	*hurt	2	0	2
Armoury	0	2	2	Invade*	1	6	7
Arsenal	4	0	4	Invaders*	1	1	2
Attack (n)	6	4	10	*Invasive*	6	3	9
Attack (v)	20	33	53	Kill	24	53	77
Battle	2	3	5	Kill off	9	1	10
Beat	4	3	7	Killer	8	8	16
Blast	1	0	1	Killing	5	0	5
Block	22	19	41	Knock out	1	4	5
Blocker	2	0	2	Launch (n)	0	2	2
Blow apart	1	0	1	Launch (v)	2	7	9
Blunt instrument	1	4	5	Legion	0	1	1
Bomb	1	2	3	Lethal	0	1	1
Bullet	4	7	11	Marshal	1	1	2
Burn	3	2	5	Mop up	1	2	3
Burst	1	0	1	Offensive	1	0	1
bust	2	2	4	Payload	0	2	2
Campaign	0	2	2	Recruit	4	4	8
Carpet-bombing	0	1	1	Recruitment	0	2	2
Choking	0	1	1	Resist	2	1	3
Collateral damage	0	3	3	Resistance	7	4	11
Combat	4	1	5	*Resistant*	8	12	20
Commanders-in-chief	0	1	1	Sabotage	1	0	1
Damage	13	23	36	Shielded	0	1	1
Defeat	1	1	2	Sledgehammer	1	0	1
Defence	6	8	14	Starv*	2	7	9
Defend	1	1	2	Stealth*	4	2	6
Destroy	17	34	51	Stockpile*	2	0	2
Destruction	1	2	3	Strangle	0	1	1
Destruct (self)	0	3	3	Strategy (n)	3	9	12
Destructive	1	2	3	Strategic	0	2	2
Eliminate	3	7	10	Strikes	1	2	3
Enemy	1	1	2	Suffocate	1	0	1
Engulf	2	0	2	Supply line	0	1	1
Enlist	0	1	1	Suppress (v)	10	6	16
Eradicate	4	4	8	Suppression	1	0	1
Fend off	1	0	1	Suppressor/er	4	6	10
Fight (n)	7	5	12	Suppressing	2	0	2
Fight (v)	16	19	35	Target*	53	107	160
Fighting (adj)	4	4	8	Throttling	0	1	1
Fighter*	1	0	1	Trojan horse	0	1	1
Fire	0	1	1	Unscathed	0	1	1
Force (n)	2	3	5	War	2	6	8
Force (v)	4	1	5	Warhead	0	1	1
Front	0	4	4	Weapon	13	4	17
Frontline	0	4	4	Win	2	2	4
Guard (v)	2	0	2	Wipe (out)	4	1	5
Guard (n)	1	2	3	Zap	2	1	3
Guerrilla	0	1	1	Total	411	535	946

Table B.4 WAR, VIOLENCE AND AGGRESSION metaphorical expressions in the Spanish subcorpus

	<i>El País</i>	<i>El Mundo</i>	<i>Total</i>		<i>El País</i>	<i>El Mundo</i>	<i>Total</i>
Abordaje	0	1	1	Embestida	1	0	1
Acabar	6	5	11	Enemigo	8	1	9
Agresión	3	0	3	Enfrentarse	1	2	3
Agresividad	5	1	6	Erradicar	2	4	6
Agresivo/a	23	43	66	Estallar	1	0	1
Aliado/a	2	3	5	Estrategia	11	20	31
Aniquilar	0	2	2	Flanco	2	0	2
Arma	4	3	7	Fortín (enemigo)	0	1	1
Armamento	0	1	1	Frente	1	1	2
Arsenal	5	1	6	Ganar	7	1	8
Asalto	0	1	1	Guerra	5	0	5
Asesino/a/s	2	1	3	Guerrillas	2	0	2
Asfixiar	1	0	1	Guerrilleros	1	0	1
Atacar	33	21	54	Indefensa	0	1	1
Ataque	3	4	7	Invadir	20	10	30
Avanzadilla	0	2	2	Invasión	9	4	13
Balas	1	1	2	Invasivo/a/s	5	8	13
Batalla	7	1	8	Invasor/a/es	2	1	3
Bélicas	0	1	1	Knockdown	0	1	1
Blanco	2	0	2	Legión	1	0	1
Bloquear	25	30	55	Lesionar	0	2	2
Bomba	1	3	4	Lidiar	0	1	1
Búnker	1	0	1	Lucha	6	8	14
Caballo de Troya	4	1	5	Luchar	6	8	14
Camuflarse	0	3	3	Matar (de hambre)	15	9	24
Cañonazo	1	0	1	Movilizar	1	0	1
Centinela	0	4	4	Navaja	2	0	2
Cerco	0	1	1	Objetivo	3	0	3
Combate	2	0	2	Pacífica	0	1	1
Combatir	23	5	28	Paliza	0	1	1
Conflicto	1	0	1	Perder (guerra)	2	0	2
Conquista	1	0	1	Primera línea	4	2	6
Dañar	7	2	9	Proyectiles	0	2	2
Daño	4	3	7	Rearmadas	0	1	1
Defenderse	3	1	4	Reclutar	2	1	3
Defender	2	0	2	Resistencia	18	11	29
Defensa/s	14	16	30	Resistente/s	14	11	25
Defensor	0	1	1	Resistir	3	1	4
Defensivo/a/s	2	14	16	Sitiar	0	1	1
Derrotar	2	0	2	Supresión	2	5	7
Desarmar	0	1	1	Supresor	26	18	44
Destrucción	6	3	9	Suprimir	9	1	10
Destructor	0	1	1	Talón	3	7	10
Destruir	21	9	30	Tregua	0	1	1
Disparar	3	0	3	Tropa	0	1	1
Efecto colateral	1	0	1	Vencer	2	2	4
Ejércitos	0	1	1	Yugular	1	0	1
Eliminar	9	6	15	Total	428	347	775

Table B.5 WAR, VIOLENCE AND AGGRESSION metaphorical expressions in *The Guardian* expressed per text

Text	Metaphorical Expression	No.
gu01	recruited, cancer-busting, recruited, busting, combat, resistance, fight, kill, weapon, target, target	11
gu02	resist, resist, damaging, damage, destroyed, damage	6
gu03	cell-killing, armed, cell-killing	3
gu04		0
gu05		0
gu06	fight, fight, killers, killing, killer, harm, damage, attack, destroyed	9
gu07	targeted, target	2
gu08	killer, block, attack, weapon, block, blocker, targets, resistance, resistance	9
gu09	combat, destroy, kill off, eradicated, fight, kill off, fight, kill off	8
gu10	non-invasive, targeted, targeted, targeted, target-seeking, targeted, target, target, blocked, "tumour suppressor genes", suppress, killer	12
gu11	eradicate, targets, killing, weapon, destruction, invade, war, won, hijack, defeat, antibiotic-resistant	11
gu12	suppresses	1
gu13	battle, suppressor, suppressed, block, killer	5
gu14	'burn out', 'burn', unhurt, damage, unharmed, bullets, kill, unharmed, arsenal, hurt	10
gu15	aggressive, target, target, aggressiveness	4
gu16	zap, blasting, blow apart, zapped, kill, non-invasive	6
gu17	blocked, damaged, block	3
gu18	beat, fight, sabotage, kill	4
gu19	fight, aggressive, invasive, aggressive, invasive, aggressive	6
gu20	suppress, guard, destructive, damage, suppress, suppressor	6
gu21	target, enemy, winning, war	4
gu22	aggressive, eliminated, aggressive, aggressive, eliminated, hits, search-and-destroy, eliminate, "burn", launched, target, blocked	12
gu23	blocking, aggressive, aggressive, target, aim at	5
gu24	fight, fend off, weapons, arsenal, cancer-fighting,	5
gu25	homing in on, aggressive, aggressive, targeted	4
gu26		0
gu27	targeted	1
gu28	weapon, beat, weapon, fight, block, targets, sledgehammer	7
gu29	marshalling	1
gu30	targeting, aggressive, targeted, targeting, "suffocate", blocks	6
gu31	fight, weapon, battle, attack, attack, resistant, resistance, resistance, stockpile	9
gu32	blocks, blocked, starving, bullet, suppressed, blocked, targeting, recruits	8
gu33	forcing, destroy, targets, attack, fight, attack, fight, attack, resistance	9
gu34	defences, resistant, killed	3
gu35	combat, recruited, attack, destroy	4
gu36	fighting	1
gu37	fight, weapon, self-defence, defences, fight, attacks, knock out, block, suppress, destroy	10
gu38	weapon, suppressing, block, targeted, blockers, block	6
gu39	'targeted', blocked, "targeted", targets, targeted, kill, targeted	7
gu40	weapon, fight, launch, fight, kills, arsenal, kill, harm, killing, suppress, wipes out, Achilles' heel, bursts, resistant, killing, resistant, kill, destroying, stealth, stealth, mopped up	21
gu41		0
gu42	targets, blocked, blocking, targeted, unharmed, damage, target, blunt instrument, blocking	9
gu43		0
gu44	suppression	1
gu45	army	1
gu46	strategy, starving, 'targeting', targeted	4
gu47	kill off, forced	2
gu48	fighters, kill, killed off, unharmed, killing, cancer-fighting,	6
gu49	fight, attacks, fight, targeted, harm, attacking, Achilles' heel, destroy, killing, cancer-killing, defend, "stealth", destroyed	13

gu50	targets, destroys, target, killing off, aimed at, kill, army, killer, destroy, bullets, attack, attack, attack, unharmed, target	15
gu51		0
gu52		0
gu53		0
gu54	invasive, aggressive, target, destroying, strikes, wipe out, killed off, aimed at, forces	9
gu55	target	1
gu56	aggressive, suppressed	2
gu57	kill, defences, resistant, harming, aggressive, resistance	6
gu58	strategies	1
gu59	beat, kill, fighting	3
gu60		0
gu61	fight, killing, damage, damaged, damage, stockpiled	6
gu62	attacked, destroys, targeted, home in on, beat	5
gu63	kill, aimed at, kill, attack, engulfing, engulf, target, resistant	8
gu64	attack, force, attacked, attacking, offensive, attacking, attack, eradicate, weapon, fight	10
gu65	force, force, wiping, defences, attacked, attack, wiped out, defences, attack, stealthy	10
gu66	fight, aggressive, suppress	3
gu67	targeting, killers, damage, kill, target, attack, fight, kill, targeted, attack, bomb, bullet, arsenal, weapons, target	15
gu68	target, aggressive, aggressive	3
gu69	aggressive, invasive	2
gu70	fighting, aggressive, weapon, killer, targeting, blocks, resistant	7
gu71	combat, killed off, killed off, damaged, destroy	5
gu72	suppressing, guard, blocking, target, suppressor, 'guard'	6
gu73	invaders, destroyed, destroyed	3
gu74	strategies,	1
gu75	non-aggressive, aggressive, aggressive, aggressive, aggressive, aggressive, non-aggressive, non-aggressive, aggressive, aggressive, eradicating, target, kill, kill, harm	15

Table B.6 WAR, VIOLENCE AND AGGRESSION metaphorical expressions in *The Times* expressed per text

Text	Metaphorical expression	No.
ti01		0
ti02	battle, fight	2
ti03	bullets, “bullets”, attack, target	4
ti04	target, killers, aggressive, aggressive, force, targeted, aggressive, aggressive, killing, target, killing	11
ti05	destroyed, kill, killed, destruction, invade, war, won, attack, destroy, kills	10
ti06	target, “collateral damage”, hitting, target	4
ti07	suppressed, suppressor, suppressed, campaign	4
ti08	blocking, blocked	2
ti09	target, aggressively, aggressively, invasive, target	5
ti10	kills, targeted, destroying, damaging, kill, hit, “zapped”, fire	8
ti11	bullets, “mop up”	2
ti12	starve, starves, eliminate, targets, starving	5
ti13	beating, kill, kill, destroy, target, knocking out, hunter-killer, destroyed, fight, destroy, self-destruct, eliminated, suppressor	13
ti14	targets, kill, armoury	3
ti15	wiping out, unharmed, kill, strategy, killing, target, destroy	7
ti16	aggressive, aggressively	2
ti17	cancer-fighting, cancer-fighting, defence, targets	4
ti18	blocking	1
ti19	weapon, mopping up	2
ti20	fight, war, launches, destroy, attack, fight, attack, launch	8
ti21	killing, self-defence, target, hit, aggressive	5
ti22	enemy, invaded, combat, throttling, choking, block, eradicate	7
ti23	kills, kill, targeting, block, damages defence, resistant, destroyed	8
ti24	fight, attacks, “Achilles’ heel”, destroy, damaging, targeted, eliminate, harming, Achilles’ heel, targeted, fight	11
ti25	target, destroys, aggressive, destroying, targeted, destroy, damage, destructive, damage, damage, targeted, targeted, weapon, strikes, destroys, damaging, unscathed	17
ti26	attacked, blocked, killing, destroyed, destroying, enlisted	6
ti27	invade, shielded, aggressive, block, suppressed, block, strikes	7
ti28	aggressive, targeted, target, blocking	4
ti29	attack, destroy, kill, destroy, attack, resistance, attack, attacks, attack, bombs, supply lines, target, kill, lethal, payload, damaging attacking	17
ti30	kill, resist, targets, kill off, kill, kill, target, kill	8
ti31	kill, target, targets, resistant, killed, eliminated, eliminated	7
ti32	cancer-busting, cancer-busting, destroyed	3
ti33	front, battle, starve, starves, block, eradicate, targeting, blocked, blocks, fight, fronts, attacks, starve, targets, recruitment, killer	16
ti34	fight, home in on, “Achilles’ heel”, recruiting	4
ti35	destroys, invade, invade, kill	4
ti36		0
ti37	attacks, fronts, frontline, resistance, resistant, starves	6
ti38	war, won, campaign, commanders-in-chief, launching, war, launch, resistance, war, guerrilla	10
ti39	fight, destroy, “bullet”, fight, fight	5
ti40	kill, blunt instruments, killed, killed, targeting, targets, collateral damage, legion, suppressed	9
ti41	hit, attack, destroyed, invasive, force, fight, attack	7
ti42	fight, strategies, defeat, strategies, attacked, attacked, weapons, recruiting, defences, attack, target, launching, killer, kill, strategy, strangle, Trojan Horse, kill, targeted, attacked, targeted, targeted, blocking, targets	24
ti43	armoury, attack, destroys, destroy, damages, damage, damage, damage, damage, damage	10
ti44	strategy, attacks, targeted, targeted, targeting, target	6
ti45	suppressor, self-destruct	2
ti46	suppressing, target, harmed, home in on, frontline, blocked, killed, target, blunt instrument, knocked out, damage	11

ti47	resistant, resistant, fight, killed, killed, fight, kill, kill, resistant	9
ti48	aggressive, target	2
ti49	'bullet', beat, targeted, 'bullets', destroy, unharmed, defences, defence, target, targeting, damage, eliminated, defences, fight, killer, attack, destroy, attacked, destroy, recruits, attack, attacks, bullets, attack	24
ti50	forces, war, launched, launched, strategic, targeted, forces, recruitment, resistant	9
ti51	aggressive, targeting, damage, killed, target, target, kill, fight, defence, fight off	10
ti52	resistant, attack, target, killed, targeting	5
ti53	invades, blunt instrument, damaging, aggressive, target, beat, burn out, launched	8
ti54	target, killing, target, damage, "targeted", hit, kill, kill, resistant	9
ti55	infection-fighting, invaders, marshal, targeting	4
ti56	aggressive, aggressive, resistant, aggressive, block, blocks, block, recruit	8
ti57	aggressive, castration-resistant, "suppressor", destroyed, frontline, eliminating, knocks out, attacked, castration-resistant, aggressive	10
ti58	blocked, destructive, self-destruct	3
ti59	fight, fight, destroy, eradicated, targeted, invasive, attack, frontline	8
ti60	attack, strategic	2
ti61	targets, killed	2
ti62	aggressive, targeted, targeted, blocking, targeted, kills, targeted, fight	8
ti63	destroys, target, attack, destroy, targeting, targeted, attack, destroy, resistance, defend, damage, damage, damage, damage, target, target, destruction	17
ti64	target, front, fight, killer, knocking out, eradicating, kill, kill, aggressive, attack, killing, killed, kill, target, target, target	16
ti65	Achilles' heel, target, targets, target, strategies	5
ti66	guard, suppressing, suppressor, target, suppressor, strategies, target, guard	8
ti67	kill, target, untargeted, killing, kills, targeted, strategies, killed, killing	9
ti68	targets, cancer-fighting, attack, target, fight	5
ti69	launch	1
ti70	target	1
ti71	targets, targets, stealth, bomb, targets, targeted, destroying, payload, "warhead", "stealth", attacked, destroyed, targeting, targeting, target, target, targeted, targets, battle, killer	20
ti72	targeted, target, target, collateral damage	4
ti73	target	1
ti74	targeted, blunt instruments, burnt, carpet-bombing, weapons, attack, targeted, target, strategies, target	10
ti75	killer, targeted, targeted, target, fight, targeted	6

Table B.7 WAR, VIOLENCE AND AGGRESSION metaphorical expressions in *El País* expressed per text

Text	Metaphorical expression	No.
ep01	invasores, agresión, acabar	3
ep02	efectos colaterales, daños, se daña	3
ep03	invasión, invasión, suprimido	3
ep04	luchar, combatir, arsenal, atacará, atacan	5
ep05	invadir	1
ep06	guerra, perdida, eliminar, asesino, combatir, combate, guerra, batalla, acaban, atacar, enemigo, combatir, atacar, armas, enemigo, atacar, atacar, arsenal, atacados, guerra, conquistas, ganar, supresor	23
ep07	ganando	1
ep08	atacar	1
ep09	combatir, bloquear, bloquear, invasión, destrucción	5
ep10	objetivo, bloqueado, bloqueando	3
ep11	bloqueo, eliminaban	2
ep12	destruir, invasivos, bloquearse, destruye, estrategias	5
ep13	perdiendo, batalla, ganando, ganando, agresivos, bloquea, agresivo, ataca, atacar, cañonazos, matan, bloquean, agresividad, agresivo	14
ep14	atacan, defensas, atacan, matar (de hambre), resistido	5
ep15	resistente, resistente, defienden, defensas, supresión	5
ep16	resistente, disparan, mata, resistencia, resistente, maten, maten, destruya	8
ep17	combatir, destruyen, destruido, agresivo, primera línea	5
ep18	Combatir, defensas, defiende, enfrenta, bloquear, defensas, luchar, combatan	8
ep19	bloqueo, defensivo, agresión	3
ep20		0
ep21	resistencia, combatir, resistentes, elimina, resistentes, resistencia, combatir, eliminarlos	8
ep22	Resistentes	1
ep23	legión, agresivo, destruyen, agresivos	4
ep24	bloquean, bloquearían, estrategia	3
ep25	caballo de Troya, caballo de Troya, matará, disparar	4
ep26	quimioresistencia, talón de Aquiles, estrategia, ataca, vencer, resistencia, resistencia, supresor	8
ep27	invasión, invadido, agresivo, agresiva, agresivos, destrucción, bloquear, agresividad	8
ep28	destruir, acabar, destruye, matar, destruiría, destruye, atacar, luchar, dañarlo, dañar, dañar	11
ep29	combatir	1
ep30	ataque, ataca, atacar, defensa, ataque	5
ep31		0
ep32	atacaría	1
ep33	supresores, supresores, supresores	3
ep34	navajas, estallar, navaja, ataca, talones de Aquiles, blanco, talones de Aquiles, destruye, resistencia, recluten, destruya, suprimidas, supresión	13
ep35	combatir, resistentes	2
ep36	matar, matar, caballo de Troya, destruiría, combatir, defensivas, invasiva, dañen	8
ep37	combatir, resistencia, resistencia, resistentes, eliminadas, combatían, asesinadas, combatidos, elimina, eliminar, resistencia, resistentes, resistente, arma, acabaremos, enemigo, enemigos, enemigos, invadidos, invadían, defensa, resistencia, combatido	23
ep38	supresores	1
ep39	defensas, combate, destruyen	3
ep40	estrategia, estrategias, enemigo, derrotar, enemigo, ataque	6
ep41	erradicar, atacando, ganar, batalla, atacar, acabó, dañar	7
ep42	defensas, defensas, se defienden, defenderse, defensas, supresor, supresores	7
ep43	estrategias, agresivo, yugulando, destruir	4
ep44	armas, atacarlas, balas, bloquearse, resistencias, ataca	6
ep45	resistencia, resistencia, resistentes, matando, resistencia, bloqueamos, defensa, estrategia, supresora	9
ep46	arma, aliado	2
ep47	agresividad, arsenal, destrucción, invadir, bloquear	5
ep48	vencer, ataques	2
ep49	agresivo, resistir, embestida, defensas, resistencia	5

ep50	arsenal, atacan, destruir, resistentes, resistente, atacar, matar, bloqueo	8
ep51	bloquear, bloquear, agresiva, agresividad	4
ep52	reclutando, agresividad, arsenal, dañar	4
ep53	invasivas, invasivas, invasión, resistencias	4
ep54	invadir, invadir, invadir, supresores	4
ep55	ganarle, batalla, ataquen, invadir, ataca, lucha, estrategia, combatir, primera línea, supresores, supresores, supresores	12
ep56	lucha, erradicaran, combatir, supresores	4
ep57	invasivos, agresivos, luchar, invadir, suprimir	5
ep58	invadir, invadiendo, invaden, agresivos, agresivas, invadir, agresivos, invadir, invadir, atacar	10
ep59	bloquear, bloqueo, suprime, suprimir, suprime, supresor, supresor, supresores, supresores, supresor, supresor, supresor, supresores, supresor, supresor	15
ep60	agresivos, invasora, invasión, agresivo	5
ep61	búnker, batalla, estrategia, acabar, invaden, disparando, ganarle, batalla, eliminar, matar, luchen, daño, daños, daños.	14
ep62	luchar, primera línea, suprimir	3
ep63	combatir, invadir, invadir, bloqueen, suprime, suprimirlo	6
ep64	invade, bloquear, aliada	3
ep65	ataca, resistencia, movilizar, eliminar	4
ep66	lucha, guerra, guerrillas, lucha, atacan, combatirlo, guerra, guerrillas, conflicto convencional, invasión, blanco, enemigo, estrategias, combatirlos, estrategia, guerrilleros	16
ep67	combatirlo, mata, combatir, atacar, asfixiar	5
ep68	lucha, batalla, objetivos, derrotar	4
ep69	invasión	1
ep70	lucha, agresivas, objetivos, frente, defensa, supresor, supresor	7
ep71	destruye, agresivo, destruir, defensa, atacadas, matando, matando, destruirlos, bomba, destruye	10
ep72	flanco, primera línea, flanco, agresiones	4
ep73	ataque, destrucción, caballo de Troya, resistir, defenderse, destrucción, destruyendo, destrucción, agresivo, agresivo, agresivo	11
ep74		0
ep75	bloquean, bloquean	2

Table B.8 WAR, VIOLENCE AND AGGRESSION metaphorical expressions in *El Mundo* expressed per text

Text	Metaphorical expression	No.
em01	luchar, destruirlas, daños, daños	4
em02	vencer, combatirlo, destruirlas, dañan, matan	5
em03	invadiendo, tregua	2
em04	bloquear, bloquear	2
em05	pacífica, agresivos, agresivos, bloquear, bloquee, supresores, supresor	7
em06	arsenal, combatirlo, lidiar, agresivos, agresivos, agresivos, agresivo, cerco, armas, avanzadilla, resistentes	11
em07	defensas, estrategias, defensas, defensas, atacan, se enfrenta, defensivos, bloqueándolos	8
em08	supresor, destruir, agresivas	3
em09	resistencia	1
em10	supresión, supresores, atacar	3
em11	luchar, bloquear, bloquearemos, eliminarlas, agresivo	5
em12	matar, lesionar, defensas, lesionar, lucha, matar, caballo de Troya, fortín, enemigo, 'matar', matar, destruiría	12
em13	defensa, agresivos, agresivos, agresivo, agresivos, supresores	6
em14	agresivo	1
em15	defensas, atacarlos, defensiva, defensas, lucha	5
em16	bomba	1
em17	invasivos, estrategias, suprimir, supresores, supresores	5
em18	bloqueando, bloquear, defensa, supresores	4
em19	defensa, defensiva	2
em20	talón de Aquiles, talón de Aquiles	2
em21	atacar, ataque, destrucción, daño, atacar, talón de Aquiles, resistencias, abordaje, resistencias, resistencias, balas, batalla, segunda línea	13
em22	centinela, reclutados, centinela, centinela, centinela	5
em23	destruir, luchar, defensas, defensivas, ataquen, defensivas, rearmadas, atacar, luchar, defensas	10
em24	vencer, estrategia	2
em25	'agresivos', agresivos, agresivos	3
em26	'defensor', destruir, estrategias, estrategias, bloquea, resistencia, supresor, supresor, supresor	9
em27	resistentes, resistencia, eliminar	3
em28		0
em29	estrategias	1
em30		0
em31		0
em32	lucha, destrucción, resistencia, resistentes	4
em33	atacar, agresivo, agresivo, estrategia, destrucción, arma, defensivas, matándolas, resistencia, se enfrenta, resistentes, se resiste	12
em34	luchar	1
em35	agresiva	1
em36	agresivas, agresiva, agresiva, supresor, supresores, supresión	6
em37	bloquea, no invasivo	2
em38	atacar, atacar, talón de Aquiles, atacarlo, lucha	5
em39	agresivos, agresivos, invasión	3
em40	agresivos, agresiva, agresivas, agresivos, agresivas, defensivas, 'bloquear', bloquea, invasiva, supresores	10
em41	resistencia, 'atacadas', estrategias, matar, agresividad, agresivo, resistentes	7
em42	invadir, invadir, invadir, invasión, invadir, bloquear, bloquear	7
em43	atacarlas	1
em44	atacar, acabar, elimina, eliminar	4
em45	lucha, erradicar, defensivas, luchar, defensivas, luchar, destruyen, estrategia, defensivas, destruyan, destructora, estrategia, defensivas, bloquea, eliminan	15
em46	matar, acabar, defensas, aniquilando, estrategia, atacarlo, defensiva, luchase, 'ejércitos', aniquilen, bloquear, bloquear, primera línea, ataque, 'asesinos', tropas, acabar, 'camuflarse', defensas, ataque, estrategias, 'bélicas', ganar, erradicarlo, arma, acabe, ataquen, frentes, ataquen, agresiva, resistente, bloqueándolo, ataque, bloqueo,	38

	erradicar, estrategias, invasor, resistente	
em47	resistencias, resistente, agresivo, invasivo, resistentes	5
em48	bloquear, bloquear, bloqueasen, lucha, bloqueo	5
em49	talón de Aquiles, agresivo, invasión	3
em50	supresión	1
em51	estrategias, desarmen	2
em52	supresores	1
em53	bloquear, bloquear, bloqueado	3
em54	avanzadilla, invasión, agresivo, agresivo, invasivo	5
em55	asalto, resistencia	2
em56	invadir, estrategias, estrategias, estrategias	4
em57	defensas, camuflarse, defensas, se defiende, camuflarse, defensas, supresor	7
em58	combatir, armamento, daños	3
em59	matar (de hambre), resistentes, resistentes	3
em60		0
em61	‘aliado’, combatir	2
em62	invasiva	1
em63	invadir, atacar, palizas	3
em64	invadir, invadir, invadir, defensivas	4
em65	estrategia, indefensa	2
em66	agresiva, agresiva, supresores	3
em67	atacar, defensivas, bloquear, agresivo, destruir	5
em68	lucha, knockdown, atacan	3
em69	‘proyectiles’, bomba, sitiar, lucha, estrategias, bomba, proyectiles, eliminando	8
em70	supresores, supresión, supresión	3
em71	‘talón de Aquiles’, combatir, ‘talón de Aquiles’, erradicación, acabar	5
em72	atacan,	1
em73	agresivos	1
em74	invasivos, no invasivo, aliado, aliada, bloqueasen, agresivos, agresiva, agresivos, agresivas	9
em75	bloqueasen, estrategias	2

Appendix C

Sample text 2. Autovacunas de diseño para matar al cancer (em46)

Desde ese instante se comenzó a trabajar para que esta *estructura defensiva luchase* contra el cáncer a través de tres vías fundamentales: fortalecer los ‘*ejércitos*’ propios para que *aniquilen* directamente a las células cancerosas, *bloquear* las señales bioquímicas que éstas emplean para multiplicarse, crecer y diseminarse, o anular los mecanismos y sustancias por los que el tumor acaba mermando el sistema inmunológico del paciente.

En un principio, los linfocitos CD8+ fueron los candidatos elegidos para formar la *primera línea de ataque* ya que estos glóbulos blancos son los verdaderos ‘*asesinos*’ de las *tropas* del organismo. Sin embargo, se observó que éstos se agotan rápido y que, además, necesitan de la participación de los CD4, que son los que les suministran los factores de crecimiento para subsistir.

De hecho, un estudio publicado el pasado año en *Blood*, concluyó que dichos linfocitos constituyen una alternativa más eficaz que los CD8 para *acabar con* un tumor. El comentario adjunto, firmado por Melero, aconseja la inclusión de los CD4 en la elaboración de las vacunas antitumorales; y no sólo por su papel de proveedor de factores de crecimiento.

Y es que el tumor no es inerte. Hace todo lo posible por ‘*camuflarse*’ y pasar desapercibido ante los *vigías* del sistema inmunitario para crecer con impunidad.

Sin embargo, «los CD4 también producen interferón gamma, una sustancia que obliga a las células cancerosas a presentar moléculas de histocompatibilidad en su superficie que lo hacen visible ante las *defensas*, algo que facilita el *ataque* de las mismas», argumenta Alfredo Prieto, profesor de inmunología de la Universidad de Alcalá de Henares, en Madrid.

Además, según el trabajo ahora publicado, los CD4 son capaces de ampliar la respuesta inmunológica. Es decir, en un primer momento se dirigen al antígeno NY-ESO-1, predominante en el tumor del paciente, pero luego desencadenan una reacción frente a otros dos (MAGE-3 y MART-1) también presentes.

En definitiva, los CD4 han resultado tener más funciones contra el *invasor* tumoral de lo que se creía en un primer momento y el caso recogido en el ‘*NEJM*’ representa uno de los colofones de esta andadura.

Sin embargo, a pesar de los avances realizados en el conocimiento de las *estrategias ‘bélicas’* que emplea el tumor para *ganar terreno* y el organismo para *erradicarlo*, desarrollar el *arma* definitiva que *acabe con* el cáncer no es sencillo.

Sample text 2. Designer self-vaccines to kill cancer (em46)

From that moment work commenced to get this *defensive structure* to *fight* against cancer along three fundamental lines: strengthening its own ‘*armies*’ to *annihilate* the cancer cells directly; *blocking* the biochemical signals used by these cells to multiply, grow and spread; and neutralising the mechanisms and substances whereby the tumour eventually debilitates the patient’s immune system.

At first, the CD8+ lymphocytes were the candidates chosen to form the *first line of attack* as these white corpuscles are the true ‘*killers*’ among the organism’s *troops*. However, it was seen that they were quickly spent and they also needed the participation of the CD4 T cells, which supply them with growth factors for their subsistence.

Indeed, a study published last year in *Blood* concluded that these lymphocytes are a more effective alternative to the CD8+ cells in *killing off* a tumour. The accompanying commentary, written by Meleró, recommended including CD4 cells in the preparation of antitumour vaccines; and not only because of their role as growth factor suppliers.

This is because a tumour is not inert. It does its utmost to ‘*camouflage*’ itself, to pass unnoticed in front of the immune system’s *lookouts*, and to grow with impunity.

However, “the CD4 cells also produce interferon gamma, a substance that obliges cancer cells to present histocompatibility molecules on their surface, which makes them visible to the *defenders*, thereby facilitating the latter’s *attack*”, argues Alfredo Prieto, professor of immunology at the University of Alcalá de Henares, in Madrid.

Moreover, according the now published report, the CD4 cells are capable of broadening the immune response; that is, first they target the tumour’s predominant NY-ESO-1 antigen, but then they activate a reaction against another two antigens (MAGE-3 and MART-1) which are also present.

In conclusion, the CD4 cells have proved to have more functions against the tumour *invader* than was first thought and the case reported in the ‘*NEJM*’ represents one of the high points along this path.

However, in spite of the advances in the understanding of the ‘*war*’ *strategies* employed by the tumour to *gain ground* and by the organism to *eradicate* it, developing the ultimate *weapon* to *finish off* cancer is not a simple matter.

Sample text 3. La lucha contra el cáncer, una guerra de guerrillas (ep66)

La lucha contra el cáncer, una guerra de guerrillas

El descubrimiento del mapa genético completo de dos de los tumores más letales y su vinculación con múltiples mutaciones modifica las bases de la *lucha* contra la enfermedad

El descubrimiento completo del mapa genético de dos de los tipos de cáncer más letales, uno cerebral y otro pancreático, realizado por los científicos del Centro Oncológico Kimmel de la Universidad Johns Hopkins de Estados Unidos ha revelado las razones que explican las dificultades que existen a la hora de encontrar una cura una vez se ha extendido el tumor y que, según sus conclusiones, se esconden bajo la mutación de numerosos genes sin un patrón establecido.

El nuevo mapa, elaborado a partir del estudio tumoral más completo que se haya realizado hasta la fecha, según destaca el propio centro, y en el que se han evaluado mutaciones en los más de 20.000 genes de 24 cánceres pancreáticos y 22 cerebrales, demuestra en opinión de sus autores que la mayoría de los casos están provocados por alteraciones en los procesos regulatorios que incluyen numerosas variables.

Según publica hoy la revista *Science*, este descubrimiento cambia el concepto acerca de los tumores sólidos y su control, así como de los fármacos u otros agentes que *atacan* los efectos fisiológicos de esos procesos. Bert Vogelstein, co director del Centro Ludwig de John Hopkins e investigador del Centro Médico Howard Hughes, ha destacado a la publicación que esos fármacos, más que las particularidades individuales de los componentes genéticos, probablemente constituyen un enfoque más útil para desarrollar nuevas terapias contra la enfermedad.

En la misma línea, su compañero de estudio, Kenneth Kinzler, profesor de oncología y codirector del centro, ha agregado a raíz de las conclusiones del mismo que “el panorama de los cánceres humanos es claramente mucho más complejo que lo que se creía hasta ahora”. “*Combatirlo* va a ser una *guerra de guerrillas* más que un *conflicto convencional* porque hay decenas de genes mutados en cada uno de los tumores”, ha asegurado.

En el cáncer pancreático, las alteraciones incluyeron el sistema de control de daños en el ADN, la maduración celular e *invasión* tumoral correspondientes a entre un 67 y un 100% de los tumores. Además de los procesos, en ambos estudios se identificaron genes mutados, incluyendo 83 oncogenes en el cáncer pancreático y 42 en la forma más letal de cáncer al cerebro, el glioblastoma multiforme.

También, se determinó una considerable sobreexposición de 70 genes en proteínas cancerígenas que están en la superficie de la célula o que son secretadas lo que los convierte en un *blanco* para un potencial diagnóstico.

Según Kinzler, considerar esas mutaciones de forma individual no parecerían ser un gran obstáculo. “Sin embargo, cuando operan de manera conjunta, se convierten en un *enemigo* que nos exigirá desarrollar nuevas *estrategias* para *combatirlos*”, explica. Por este motivo, para el científico la mejor *estrategia* a largo plazo “será la detección temprana de los tumores, cuando el número de *guerrilleros* es todavía pequeño y todavía se les puede controlar”.

Sample text 3. The fight against cancer, a guerrilla war (ep66)

The *fight* against cancer, a *guerrilla war*

The discovery of the complete genetic map of two of the most lethal tumours and their connection with multiple mutations modifies the basis of the *fight* against the disease

The discovery of the complete genetic map of two of the most lethal types of tumour, a brain tumour and a pancreatic tumour, which was made by scientists of the Kimmel Cancer Center at Johns Hopkins University in the United States, has revealed the reasons that explain the existing difficulties that exist in the search for a cure once the tumour has spread, which, according to their conclusions, lie hidden beneath the mutation of numerous genes with no established pattern.

The new map, elaborated from the most complete tumour study conducted so far, as pointed out by the Center, in which mutations were evaluated in more than 20,000 genes in 24 pancreatic cancers and 22 brain cancers, shows in the authors' opinion that most cases are caused by alterations in the regulatory processes that include numerous variables.

Published today in the journal *Science*, this discovery changes the concept of solid tumours and their management, as well as the drugs and other agents that *attack* the physiological effects of these processes. Bert Vogelstein, co-director of the Ludwig Center at Johns Hopkins and researcher at the Howard Hughes Medical Center, said in a statement to the journal that these drugs, rather than individual gene components, are likely to be a more useful approach for developing new therapies against the disease.

Along the same lines, his co-author, Kenneth Kinzler, professor of oncology and co-director of the Center, added with regard to the conclusions of the study that "the panorama of human cancers is clearly much more complex than was previously believed". "*Fighting* it is going to be more of a *guerrilla war* than a *conventional conflict* because there are dozens of mutated genes in each tumour," he assured.

In the pancreatic cancer, the alterations affected the DNA damage control system, cell maturation, and tumour *invasion* and corresponded to between 67 and 100% of the tumours. Besides the processes, both studies identified mutated genes, including 83 oncogenes in the pancreatic cancer and 42 in the most lethal form of brain tumour, glioblastoma multiforme.

They also found a considerable overexposure of 70 genes in cancer proteins located on the surface of cells or secreted, which makes them a potential diagnostic *target*.

According to Kinzler, to consider these mutations individually would not seem to be a great obstacle. "However, working together, they form an *enemy* that will require us to develop novel *strategies to combat* them", he explained. For this reason, according to the scientist, the best long-term *strategy* "will be early detection of tumours, when the number of *guerrilla warriors* is still small and they can still be controlled".

Sample text 5. El científico Joan Massagué descubre la clave de la metástasis de cáncer al pulmón (ep49)

El científico Joan Massagué descubre la clave de la metástasis de cáncer al pulmón

Cuatro genes se coordinan para facilitar la *diseminación* de un tumor desde la mama

Para que surja una metástasis, la *diseminación* de un cáncer, una célula tumoral debe realizar un largo y peligroso *viaje* y tiene que hacerlo en unas condiciones precisas para que su *misión* última, la formación de un nuevo tumor en un órgano distante, tenga éxito. Esas condiciones, de acuerdo con los resultados de un estudio sobre el cáncer de mama liderado por Joan Massagué, dependen de la activación anómala de unos pocos genes. Gracias a ellos se forman nuevos capilares por donde *escapa* la célula tumoral del tumor primario y se *abre paso* hasta alcanzar el pulmón.

El equipo del investigador español Joan Massagué, director del programa de Biología y Genética del Cáncer en el prestigioso Memorial Sloan-Kettering Cancer Center de Nueva York (MSKCC) y director adjunto del Instituto de Investigación Biomédica de Barcelona (IRB), ha identificado hasta la fecha un paquete de 18 genes fuertemente *implicados* en la aparición de metástasis. De todos ellos, según su nuevo trabajo, la acción conjunta de tan sólo cuatro provoca al menos dos fenómenos esenciales para que las metástasis tengan lugar. Por un lado, la formación de nuevos vasos sanguíneos alrededor del propio tumor y, del otro, la *perforación* de los pequeños capilares que proporcionan alimento y oxígeno a un órgano determinado. En el estudio de Massagué, que hoy publica la revista *Nature*, los órganos afectados son las mamas y los pulmones.

Los cuatro genes estudiados dan lugar a la formación de sendas proteínas “bien conocidas”, describía ayer Massagué en conversación telefónica. Se trata de la epirregulina, COX2 y de dos variantes de metaloproteasas que la célula excreta en su espacio exterior. De estas proteínas era conocida su *implicación* en procesos inflamatorios y su presencia en procesos tumorales, pero se ignoraba el papel esencial que juegan en la *diseminación* de tumores y, aún más, que se precisara de la actividad conjunta de todas ellas. “Es como una *caja de herramientas*”, ilustra Massagué. “*Para hacer un agujero en la pared necesitas una escarpia y un martillo, pero ambos deben usarse conjuntamente*”.

La acción conjunta de estas cuatro proteínas provoca, según se ha visto en experimentos realizados en 738 tumores de mama humanos inducidos a ratones, la formación de nuevos vasos sanguíneos alrededor del tumor, fenómeno conocido como angiogénesis. Gracias a estos nuevos vasos, el tumor se nutre de oxígeno y alimentos adicionales, factor que favorece su crecimiento. Pero estos vasos presentan algo así como una imperfección, son porosos. A través de los poros *escapan* las células tumorales hacia el torrente sanguíneo. “Sabíamos que por cada centímetro cúbico de un tumor agresivo [tamaño equivalente a un garbanzo] puede llegar a *escaparse* hasta un millón de células malignas”, señala Massagué. Lo que no se sabía era exactamente cómo ni cuáles eran los genes y proteínas *implicados*.

También se sabía que, una vez alcanzado el torrente sanguíneo, las células tumorales deben estar “suficientemente *preparadas*” para *resistir* la *embestida* del sistema natural de *defensas* y, en un momento dado, salirse del sistema circulatorio para *anidar* en un órgano distante. El trabajo publicado por Massagué explica cómo la célula maligna se sale de los capilares que alimentan a los pulmones y propone claves para entender su *resistencia* en un medio tan hostil como la sangre.

De nuevo, es la acción conjunta de las cuatro proteínas lo que permite que una célula cancerosa *se abra paso* literalmente entre las células que forman la pared de un minúsculo capilar. Y lo que se ha visto es que lo hacen casi como resbalando entre las sustancias que *cementan* las células del capilar.

Sample text 5. The scientist Joan Massagué discovers the key to lung metastasis (ep49)

The scientist Joan Massagué discovers the key to lung metastasis

Four genes coordinate to facilitate *dissemination* of a tumour from the breast

For metastasis, the *dissemination* of a cancer, to occur, a tumour cell has to make a long and dangerous *journey* and must make it in very precise conditions for its ultimate *mission*, the formation of a new tumour in a distant organ to be successful. These conditions, according to the results of a study on breast cancer led by Joan Massagué, depend on the anomalous activation of a few genes. Thanks to them, new capillaries are formed through which the tumour cell *escapes* from the primary tumour and *opens a way* to the lung.

The team of Spanish researcher Joan Massagué, head of the Cancer Biology and Genetics program at the prestigious Memorial Sloan-Kettering Cancer Center of New York and joint director of the Biomedical Research Institute (BRI) in Barcelona, has so far identified a set of 18 genes strongly *implicated* in the development of metastasis. Of these, according to their new paper, the combined action of only four causes at least two phenomena essential for metastasis to occur. On the one hand, the formation of new blood vessels round the tumour itself and on the other, the *perforation* of the small capillaries that supply nutrients and oxygen to a specific organ. In Massagué's study, published today in the journal *Nature*, the organs involved are the breasts and the lungs.

The four genes studied give rise to the formation of their respective "well-known" proteins, said Massagué yesterday in a telephone conversation: namely, epiregulin, COX2 and two metalloprotease variants that the cell excretes into its outer space. These proteins were known to be *implicated* in inflammatory processes and to be present in tumour processes, but the essential role they play in tumour *dissemination* was not known, nor was it known that this requires their combined activity. "It's like a *toolbox*," explained Massagué. "*To make a hole in the wall you need a hook and a hammer, but both must be used together.*"

The combined action of these four proteins, as seen in experiments performed in 738 human breast tumours induced in mice, results in the formation of new blood vessels around the tumour, a phenomenon known as angiogenesis. These new vessels supply the tumour with oxygen and additional nutrients, thus favouring its growth. But these vessels present a kind of defect in that they are porous. The pores enable the tumour cells to *escape* into the blood stream. "We knew that for every cubic centimetre of an aggressive tumour [the size of a chickpea] as many as a million malignant cells can *escape*," Massagué pointed out. What we didn't know was exactly how or which of the genes or proteins were *implicated*.

We also knew that, once in the blood stream, the tumour cells must be "sufficiently *well-prepared*" to *withstand* the *attack* of the natural *defence* system, and at some point to leave the circulation to *nest* in a distant organ. The paper published by Massagué explains how the malignant cell leaves the capillaries that feed the lungs and proposes keys for the understanding their *resistance* in an environment as hostile as blood.

Again, it is the combined action of the four proteins that allows a cancer cell to literally *break through* the cells that form the wall of a tiny capillary. And they have been seen to almost slip between the substances that *cement* the capillary walls.