The Translator
Studies in Intercultural Communication

Volume 17, Number 2, 2011

Science in Translation

Special Issue

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Abstract. Research in translation has until quite recently tended to eschew the translation of scientific material as a possible site of critical inquiry, with the exception perhaps of popular science, despite the prevalence of scientific texts and their related fields in translation practice. Moreover, historical perspectives on the transmission of scientific knowledge have not generally acknowledged translation and its potential to generate epistemological, narrative and ideological shifts in the dissemination of scientific discourse. In contrast, social constructivist perspectives which account for human intervention and contingency in the representation of science promote an analysis of translated scientific material that focuses on issues of rhetoric, ideology and translator’s agency. Drawing on the sociology and history of science, the history of ideas as well as various frameworks for textual analysis, the contributors to this special issue engage with different perspectives and approaches to help promote the visibility of scientific translation and shed light on its complex relationship with power and the construction of knowledge.

Keywords: History of Science, Metaphor, Narrative, Scientific discourse, Translation, Construction and dissemination of knowledge.
Within translation studies, scientific models are sought to explain and describe translation processes at the same time that scientific discourse itself remains relatively under-researched. Moreover, although very few translation training programmes prepare translators for professional work without engaging with scientific texts, translation studies as a discipline draws its examples or case studies overwhelmingly from other types of discourse (Salama-Carr 2009). And technological advances that have provided more powerful tools for the translation researcher – such as electronic corpora, audiovisual techniques and equipment, and multimedia platforms – have not necessarily led to a sharper focus on scientific discourse. Institutional and discipline-related factors also come into play: most translation studies researchers are located outside scientific disciplines. Access to data is another factor to be reckoned with: due to issues of confidentiality and lack of familiarity with subject knowledge, scientific material, outside popular science publications, is not always accessible. In order to redress the problem of the relatively sparse coverage of the translation of science in translation research, this special issue of The Translator offers a range of theoretical and empirical perspectives on a number of themes relevant to science translation.

Notions of universalism and objectivism have long persisted in translation scholars’ deliberations on scientific and technical texts (Olohan 2009, forthcoming). Translation studies has traditionally taken inspiration from traditional LSP (Language for Specific Purposes) research and terminology studies in analyzing intrinsic features of specialized discourse; those studies often perpetuated a view of science as consisting of absolute truths, involving objective and referential communication. This approach overlooks the nature of terminological work, which is not merely linguistic but also involves conceptual reflection (Ducos 2008).

Fields such as the philosophy of science, the sociology of science and the history of science have challenged the notion of scientific knowledge as universal and neutral, as well as the view of scientific theories as immutable. Scientific texts are increasingly viewed as multilayered, representing the results of sometimes centuries of theorizing, argumentation and counter argumentation. Sarukkai, reviewed in this special issue, reminds us that “[t]he writing of science is not only a representation of the ideas of science; it is also integral to the creation of new meanings and truth claims (2002:1). Diverse scholarly approaches have emerged which treat knowledge as locally contingent and socially constructed and have developed conceptions of science such as ‘science as public culture’, ‘science as institution’, ‘science as narrative’ and ‘science as rhetorical practice’.

Translation studies, with its recent shift towards sociologically inspired research, has also become more receptive to studies of scientific translation which recognize the contingency of knowledge, the complexities involved in its communication and circulation, and how it is shaped and reshaped in and
through translation. The papers in this volume reflect the most recent work in this area. Several authors emphasize the social and historical contexts in which the translation of scientific texts takes place; they trace the decision-making of translators through textual and paratextual analysis and relate these choices to socio-culturally embedded world views, theological doxa, scientific orthodoxies and moral codes. Others focus on the contemporary translation of popular science, acknowledging the dialectal relationship between text and context and the translator’s positioning in the interaction between writers and readers. The challenges for translators posed by specific features of scientific discourse, including register, and by metaphorical conceptualizations reflected in scientific texts are also explored. The wide-ranging influence of translation in contributing to shaping scientific writing conventions and enhancing the accessibility of scientific information is also addressed. Finally, the issue of how science translation contributes to epistemological shifts is a theme that emerges in several of the contributions.

Karen Bennett’s paper, ‘The Scientific Revolution and Its Repercussions upon the Translation of Technical Discourse’, charts the manner in which the shift from a humanist to a scientific world view brought about by the scientific revolution of the 17th century effected changes in scientific discourse, with English-language based scientific discourse eventually providing the model which was then calqued by other discourses. This new scientific discourse was characterized by linguistic transparency, logical reasoning and a noun-based grammar. Bennett explores each of these features before tracing how the process of calquing, which she interprets as a form of linguistic colonization in this context (Phillipson 1992, Pennycook 1994), took place. While the task of present-day translators of scientific discourse from or into English is often facilitated by the fact that the English discourse is mirrored in other languages, Bennett argues that in languages such as Portuguese, for example, calquing also produced rhetorical and grammatical inconsistencies which would not have arisen had this scientific discourse emerged through internal processes of evolution. This presents challenges to translators where certain tensions arise between the calqued discourse and the language’s own structures and rhetorical traditions. Bennett illustrates this through examples from Portuguese texts, focusing on nominalizations, impersonal verb forms and other remaining traces of the traditional Portuguese discourse. She concludes by offering some thoughts on the long-term consequences of linguistic colonization which imposes new ‘mental structures’ (Phillipson 1992:166) or destroys existing ways of construing knowledge.

Focusing on the emergence of a discourse of engineering in Japan during the Meiji era (1868–1912), Ruselle Meade’s article, ‘Translation of a Discipline: The Fate of Rankine’s Engineering Science in Early Meiji-era Japan’, discusses how the work of W. J. M. Rankine, a British professor of engineering, and his approach to the practice and the academic study of engineering came
to prevail in the Japanese context, first through the use of English language textbooks and then through the medium of translations, consecrating Rankine’s work as a form of orthodoxy. The article exemplifies the complexity and non-linearity of knowledge transfer when competing discourses jostle for dominance. It also reveals how the transmission of knowledge, in this case accomplished through translation, almost inevitably involves a reconceptualization of the discipline. Drawing on Foucault’s notion of ‘discourse’ to explain the conceptualization of engineering as a discipline, Meade describes the fluid way in which translations were produced during this period on the basis of abridged versions and existing translations, without necessarily making any explicit reference to the original source, and with significant intervention in terms of omissions and adaptations of illustrations. This considerable textual intervention contributed to the epistemological shift in engineering pedagogy that began with Rankine’s efforts to rationalize engineering practice in order to elaborate an engineering science.

Lieve Jooken and Guy Roorick’s ‘The Freedom of Expressing One’s Ideas: Translating La Mettrie’ provides a thorough and detailed case study of the English translation of an early scientific French text and the contexts in which the text was produced and translated. The French philosopher La Mettrie (1709-1751) played an important role in the way medicine and philosophy became interconnected during the Enlightenment. La Mettrie brought his medical training and experience to bear upon his discussion of Man’s intellectual power and the relation of body and soul in his famous treatise L’homme machine, which challenged the prevailing theological doxa from a materialist standpoint. Jooken and Roorick’s paper draws a fascinating and complex picture of the Enlightenment milieu in which La Mettrie’s writings were formulated and received, first in their French originals and later, and more importantly, in their English translation. Their analysis of the English version reveals the importance of translation in conveying and reshaping scientific propositions and the philosophical assumptions which underpin them or, conversely, are generated from them. The authors chart the interconnection between science, religion, rationalism and faith with reference to key thinkers such as Malebranche, Bayle and Descartes. They then examine the textual profile of La Mettrie’s original text and its English translation in order to identify the author’s and his translator’s use of hedging devices. Moving on from the paratextual elements in these works, they consider the reception and impact of the translation in its English context. The analysis shows how La Mettrie’s materialist stance was made both explicit and acceptable to the English readers. Given that historians and historiographers of translation do not generally engage with the propositions and metalanguage of mainstream translation studies, this study is a welcome ‘testing ground’ of some of its paradigms.

Richard Somerset’s paper, ‘The Translation of Louis Figuier’s La Terre avant le déluge’, presents an example of how translation strategies and
shifts, often operating at the micro-linguistic level, can transform a text into one which serves and is compatible with a prevailing ideological perspective or target culture world view that is diametrically opposed to that of the source text and source culture. Somerset’s paper centres on Figuier’s 1863 work, which provided a non-specialist account of the newly emerging field of paleontology. Such popular accounts took the form of a History of Life, a story which gripped and engaged readers while discretely conveying certain ideological orientations. According to the author, Figuier had a dual aim in writing his text as he did, namely, to counter evolutionary sympathies and to promote empiricism over fantasy as a basis on which to educate young people. These aims were linked in that the more fantastic accounts of life were more likely to engender support for an evolutionary stance. Figuier told the story in a naturalistic manner which relied on empirical detail while managing to achieve a balance between an empirical foundation and an imaginative appeal by including speculative illustrations of geological ages by Edouard Riou. Figuier’s narrative moved through different epochs so as to produce a sense of global continuity through divine intervention. However, he avoided conveying this as a progression based on evolution by presenting the beings of successive epochs primarily in terms of their differences, rather than their similarities. Somerset’s analysis focuses on the shift in perspective found in the English translations of Figuier’s text. He argues that the translations were less empirical and less anti-evolutionary and that the translators employed strategies to make the text more acceptable to British readers by demonstrating the compatibility of science with their moral values and considerations.

Evolution, specifically Darwin’s formulation of this idea, is also the focus of the paper by Sonia Vandepitte, Liselotte Vandenbussche and Brecht Algoet, entitled ‘Travelling Certainties: Darwin’s Doubts and Their Dutch Translations’. The authors’ starting point is Brisset’s (2002) study of Royer’s French translation of Darwin’s On the Origin of Species (1859), which found that the French translation had been adapted to the French positivist style and conveyed a higher degree of certainty than the English text. They analyze two Dutch translations, one from 1860 and another from 2000, to establish whether these translations show similar shifts in certainty or epistemic stance (Kärkkäinen 2003) to those of Royer’s translation. Modal forms are investigated using an adapted version of Martin and White’s (2005) epistemic scale of ranking; the degree of likelihood, or epistemic modality, is determined for statements in Darwin’s text and the two Dutch translations, using a five-point scale which ranges from tentative possibility to certainty. This systematic analysis reveals that Darwin nuanced his findings and expressed them quite tentatively, often using epistemic modal verbs. The quantitative analysis shows that both translations tended to express those ideas with a greater degree of certainty but that the shifts towards greater certainty were much more prevalent and more marked in the 1860 translation than in the modern text, which is much closer
to the original in terms of epistemic stance. A qualitative analysis explores the role of co-textual factors in characterizing the differences between the two translations. In addition to offering a better understanding of the expression of possibility or certainty in Darwin’s text and the Dutch translations, the paper provides an example of a useful methodology for systematically investigating a translator’s epistemic stance. It concludes by suggesting possible explanations for the epistemic shifts identified, including the prevailing world views at the time, the translators’ own perspectives on evolution, differences between the two language systems and differences in genre conventions.

Mark Shuttleworth’s paper, ‘Translational Behaviour at the Frontiers of Scientific Knowledge: A Multilingual Investigation into Popular Science Metaphor in Translation’, continues the exploration of conceptual shifts by focusing on the way metaphorical expressions, which abound in scientific and science-related material, are translated as part of the transfer of scientific concepts. Midgley has noted that “it surely is striking how deeply scientific thinking is pervaded by patterns drawn from everyday thought and, in particular, how strong an effect the imagery chosen has on what is conceived at a given time as being scientific” (2006:81). Shuttleworth aims to track the translation of metaphor on both micro- and macro-levels in the search for patterns across languages, drawing on a wealth of examples provided by different language versions of Scientific American. Mindful of the need to avoid hasty generalizations, he unpacks the complex nature of the corpus to investigate how metaphor fares through translation at the levels of individual metaphorical expression and metaphorical mapping.

Dolores Sánchez’s contribution, entitled ‘Translating Science: Contexts and Contests. On the Translation of a Misogynist Scientific Treatise in Early Twentieth-Century Spain’, explores translation as a site of ideological and discursive conflict. While Somerset’s study reveals how the paratextual interventions made by Figuier’s translators reflected differences in ideologies prevailing in France and Britain at that time, in Sánchez’s study, which also focuses on the paratextual elements of a translation, the divergent ideological positions in conflict are those of the source author and the translator. Sánchez examines the Spanish translation by Carmen de Burgos, a Spanish writer well known for her feminist ideas, of a German text by Möbius from 1900 which sought to establish that women were mentally inferior to men. Though it seems at first incongruous that de Burgos would choose to translate an overtly misogynist text, Sánchez shows how the translator uses paratextual elements to introduce her own voice into the translation, creating a discursive dissonance in the text by using the prologue and footnotes to critique Möbius’s argument and adding several of her own essays on the plight of women. Sanchez contextualizes her analysis of the paratextual elements of de Burgos’s translation in the Spanish socio-historical situation at the start of the 20th century. As she points out, De Burgos’s challenge to the existing medical discourse on
women was all the more significant as she occupied a discursive and social space from which women were largely excluded, even though her reasoned arguments provided counter-evidence to Möbius’s claims that women were incapable of intellectual activities. Sanchez frames her study using gender and critical feminist perspectives to provide an insight into the complexities of de Burgos’s assertion of agency which, given the socio-historical circumstances, used the dominant discourses as a vehicle through which to mount her resistance to them.

Recent publications (Cunico and Munday 2007, Carbonell and Salama-Carr 2009) have begun to foreground the ideological underpinnings of popular science and its translation. Offering another challenge to the often presumed neutrality and objectivity of scientific discourse and the invisibility of the translator of science, Min-Hsiu Liao, in a paper entitled ‘Interaction in the Genre of Popular Science: Writer, Translator and Reader’, draws on de Beaugrande and Dressler’s (1981) notions of intentionality and acceptability to consider how writers position themselves in texts and how readers participate in the process of reading. The linguistic features deemed most relevant for studying these interactive aspects are deixis, first and second person reference and junction. Drawing her data from a corpus of *Scientific American* texts in English and their Chinese translations published in Taiwan, as well as a Chinese reference corpus, Liao finds that the interactive features analyzed are considerably more frequent in the Chinese translations than in the Chinese reference corpus; in some cases they also occur more frequently in the Chinese translations than in the English source texts. Liao’s quantitative findings are supplemented by an analysis of examples from the corpus which explores how translators position themselves in the interaction between writers and readers. Liao uses the examples as a basis for a discussion of readers’ participation in the text, writer-reader solidarity, and the writer’s and translator’s presence in the text. The translators of these popular science texts appear to position themselves closer to the target readers than to the source text writers, and their visibility, through publication of their names and their profiles, contributes to conveying to target readers a sense of the translators’ authority over scientific discourse. Liao’s interviews with editors and translators also provide evidence of the value attributed by the magazine to the scientific credentials of its translators and their sense of responsibility regarding their role of mediating scientific discourse and enhancing the scientific literacy of Taiwanese society.

Another paper which foregrounds the issue of translators’ authority over scientific texts is Hala Sharkas’ ‘The Use of Glossing in Modern Original Scientific Writing in Arabic: An Influence of Translation’. Sharkas links the feature of glossing to a long tradition which can be traced back to medieval Europe. She reviews both the historical, linguistic and educational contexts in which glossing is used and the discussions of this particular feature that are found in the translation studies literature. Given the pervasive use of glossing in original as well as translated texts in Arabic, and supported by examples from
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the corpus, Sharkas argues that glossing is not only used to add clarity and precision, but that it has also become a stylistic feature of scientific writing in Arabic. Beyond this, the article contributes to the identification of translation-related writing conventions that strongly privilege the information content of scientific writing and highlights the role played by glossing in enhancing clarity and supporting standardization in science translation.

Monika Krein-Kühle, in a paper entitled ‘Register Shifts in Scientific and Technical Translation: A Corpus-in-Context Study’, like Liao, draws on corpora to analyze shifts in scientific and technical translation. Her aim in doing so is twofold; to argue that corpus-based translation studies should focus more on the quality of the translations included in corpora, and to investigate how aspects of register influence the translation of specific linguistic features – namely the verbs have and be – in scientific and technical texts. With regard to the first aim, Krein-Kühle proposes a notion of high-quality translation, achieved through functional constancy and equivalence at the textual level. Only such high-quality translations, she argues, are of value or relevance in studying translational regularities. This principle leads to the formulation of a set of corpus compilation criteria which have been applied in the case of the Cologne Specialized Translation Corpus project, the corpus from which data is extracted to address the second aim of the paper. Krein-Kühle provides a quantitative account of the occurrence of have and be as main verbs in the corpus and of the strategies used in the translation of these texts into German. A significant trend identified is that both verbs are often translated by semantically more specific verbs in German. Krein-Kühle argues that this selection of verbs is influenced by aspects of register, where register is understood as a situational, use-related variety which operates at all text levels, and which may be governed by further factors such as domain knowledge and genre conventions. Based on these findings, Krein-Kühle calls for greater homogeneity in translation corpora to ensure sufficient contextualization of investigations and findings.

Finally, in ‘The Audio Description of Scientific Multimedia’, Lidia Camara and Eva Espasa take as their point of departure the growing use of multimedia documents to disseminate scientific knowledge as a fledging trend of research. The authors focus on audio-described documentaries, a form of constrained translation (Mayoral et al. 1998), in order to investigate the extent to which current technologies provide solutions for the description of scientific products beyond existing practices in the field. The examples are drawn from the audio description of National Geographic Society Television nature documentaries. The aim of the article is to explore how visual accessibility can be furthered for the blind and visually impaired audiences given that “images are central to scientific and technical contexts at all levels of specialization, conveying important information that complements or substitutes that contained in the text” (Tercedor-Sánchez et al. 2009:143). The authors’ focus on the importance and omnipresence of figurative language in
conveying the shapes and movements of specific images shown on screen is a reminder of the centrality of metaphor to scientific discourse in general, and to audio-description in particular.

This special issue constitutes a much needed forum for the interrogation of scientific discourse through translated materials, providing insights into the translation of science across time and national borders and shedding light on the agency of the translators who contribute not only to the dissemination of science across national and linguistic borders but also play a role in the constitution of scientific discourse itself. It sets out to reframe the account of interlingual transfer of scientific knowledge at the core of the transmission of knowledge and its related philosophical and societal implications and effects. Starting from the assumption that scientific discourse remains relatively under-researched and under-problematized in mainstream translation studies, despite the prevalence of science and science-related material in high-level translator training and in the realm of professional practice, the issue foregrounds the work of researchers, within or on the periphery of translation studies, who have begun to interrogate the representation of scientific knowledge through translation. Their papers, informed by different scholarly traditions, present complementary historical, sociological, linguistic and philosophical perspectives with which to chart the translation of science. Taken together, they showcase the importance and the multilayered nature of the translation of science. It is our hope that the themes covered in the present issue, and the debates entered into, indicate that the claim “there has been minimum engagement between the discourses of translation and science” (Sarukhai 2001:120) no longer holds.

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References


The Scientific Revolution and Its Repercussions on the Translation of Technical Discourse

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Abstract. The Scientific Revolution of the 17th century not only revolutionized the English world view, it also brought about profound changes on the level of discourse. Through a process of grammatical metaphorization (Halliday and Martin 1993), primary experience was linguistically reconstrued to create a picture of a static objective universe from which all subjectivity was effectively removed. The Catholic cultures of Continental Europe were initially resistant to the scientific worldview, remaining loyal for political and religious reasons to the earlier humanistic model (Bennett 2007a, 2007b). Nevertheless, by the late 20th century, with the pressures of globalization, most had developed a scientific discourse of their own, essentially calqued from the English model. The fact that this discourse was borrowed however, rather than resulting from an internal process of evolution, has led to certain grammatical and rhetorical inconsistencies, which raise problems for translation. This paper discusses some of the technical issues besetting the English translator of Portuguese scientific texts, including difficulties related to nominalizations, impersonal verb structures and the intrusion of features from the traditional discourse. It also considers ethical and epistemological questions resulting from the process of linguistic colonization (Phillipson 1992, Pennycook 1994).

Keywords: Scientific discourse; Scientific Revolution; Portuguese; English; Linguistic imperialism; Calquing; Language change; Hybrids.

For the professional translator working into or out of English, scientific and technical texts are an abundant and lucrative source of revenue. The fact that English is the undisputed lingua franca in these fields means that a great deal of translational activity takes place to and from that language as new knowledge is spread across the globe, and the close connection that science has always had with industry and business means that there is a great deal of money around to pay for it. Moreover, this kind of translation is relatively easy, at least compared to more literary genres. As Halliday and Martin (1993:63) have pointed out,
the grammar of scientific discourse is very restricted in scope; while technical vocabulary might present some problems, the availability of terminological databases, translation tools and online translator forums considerably eases the burden upon individual translators.

The translation of scientific and technical texts is also facilitated by the fact that the discourse of science in most languages is to a large extent a mirror image of the English equivalent. Halliday and Martin (1993) have shown that this discourse has its roots in a major linguistic upheaval that took place in seventeenth-century England, when primary experience was grammatically re-construed to create a new world view that focused on things rather than words. This was then exported to other cultures through a process of calquing, which was partly a by-product of translational activity (Cronin 1998/2010:21, House 2006), partly due to spontaneous imitation and partly imposed by host culture authorities seeking to partake of the economic benefits that science brings.

However, the fact that non-English scientific discourses have been calqued, rather than resulting from an internal process of evolution, often leads to inconsistencies of both a grammatical and rhetorical nature. These include ambiguities caused by the underlying structure of the target languages, which may not always lend themselves to the grammatical reformulations demanded in English, as well as the unintentional intrusion of features from traditional indigenous writing styles. Such characteristics can create unexpected problems for translators working into English.

This paper begins by examining the historical processes that led to the current situation, focusing firstly upon the Scientific Revolution and the forging of English scientific prose, and secondly, upon the process of exportation that resulted in the development of equivalent discourses in other languages. This historical perspective is then used to elucidate some of the concrete problems facing the English translator of Portuguese scientific texts today.

1. The Scientific Revolution: a new worldview

Although the term ‘Scientific Revolution’ is today disputed by scholars seeking to emphasize the continuity of the scientific project with the Medieval and Renaissance past, on the level of discourse at least, there is evidence that a major epistemological shift took place in the 17th century that had far-reaching repercussions. This shift can be summed up by Francis Bacon’s famous injunction, “think things not words”, which meant that knowledge was no longer to be sought in ancient texts but rather was to be found outside language, through the systematic observation of the natural world.

This shift had a number of linguistic consequences. First, transparency became a requisite in order to convey observations of the natural world more accurately, without leaving traces of human manipulation. Thus, the elaborate rhetorical flourishes beloved of the Elizabethans dropped out of fashion, and
a new plainer style was cultivated which focused almost exclusively upon the referential dimension of language at the expense of the interpersonal. Secondly, logical reasoning came to be seen as the only acceptable method of persuasion, causing the emotive strategies of the humanists to be viewed as forms of manipulation that obscured rather than illuminated the truth about things. Thirdly, and most importantly for our purposes, the clausal-based grammar of everyday language was beginning to reveal its limitations as a vehicle for the new paradigm. Hence, as Halliday and Martin (1993) have shown, over the course of several centuries the discourse of science effectively enacted the Baconian emphasis upon ‘things’ by developing a new noun-based grammar that ultimately removed the subjective observer from the picture altogether. Each of these points is examined in turn below.

1.1 Linguistic transparency

Modern factual discourse is predicated upon the belief that there exists an external reality that is independent of human perception and sign systems, which can be observed, analyzed and discussed in an entirely objective fashion. This notion has not always been with us. For the Renaissance humanists, and the Scholastics before them, all knowledge resided in words; hence, it was to be acquired through the exegesis of authoritative texts and by rigorous training in the use of language. Indeed, in schools, the tripartite study of language (Grammar, Rhetoric and Dialectic) occupied a central role in the curriculum for centuries (Timmermans 1999/2002, Conley 1990).

In the Classical/Humanist rhetorical tradition, it was important for an author or orator to adjust his language to suit the circumstances and the public he was addressing. There were three main styles to choose from, associated with three modes of persuasion. The high-flown elaborate ‘grand’ style relied primarily on pathos (an appeal to the audience’s emotions), while the ‘plain’ style was terser and depended more upon logos (the appeal to logic) and/or ethos (the appeal to the authority or moral character of the speaker). There was also a ‘middle’ style, which attempted to strike a compromise between the other two (Timmermans 1999/2002, Conley 1990).

It was after the Reformation, with the rise of the Anti-Ciceronian movement, that the grand style of rhetoric began to fall into disrepute in England. It was naturally distrusted by Protestants, who eschewed ornamentation and artifice in all realms of life, and its appeal to the emotions began to be condemned as sophistry or unfair manipulation. Hence, of the three Classical styles, the ‘plain’ style was gradually reified as the only worthy vehicle of the ‘truth’ (Croll 1929/1969, Partridge 1969:45-49). This represented an important shift in the domain of philosophy of language. Instead of mediating our knowledge of reality, words were now seen as offering a transparent window onto the outside world, a perspective that is today known as linguistic
realism. One of the consequences of this was the perception that form and content were ultimately separable, suggesting that the ‘meaning’ of any given text could be extracted, summarized, reformulated and translated without any essential loss. As Venuti (1995) has shown, this perspective has had profound consequences upon intercultural transfer mechanisms, resulting amongst other things in unacknowledged distortions of foreign texts and the assimilation of other worldviews to the dominant (English) model.

In the context of factual discourse, the implications are particularly significant. For while Anglophone culture favours a plain straightforward style on the grounds that it more accurately reflects the ‘truth’ about things, this premise is not necessarily taken for granted elsewhere. The Catholic cultures of Continental Europe, for example, which long resisted the scientific paradigm for identity and political reasons, cultivated a much more opaque elliptical style of scholarly writing which is still prevalent in humanities and social science disciplines today (Bennett 2007a, 2007b, 2010, 2011). Although most of these cultures have now developed a form of scientific discourse that is, to all intents and purposes, calqued from the English, aspects of the traditional style still sometimes intrude into scientific texts, causing problems for translators.

### 1.2 Logical reasoning

The victory of logos over pathos as a form of persuasion clearly owed much to the influence of Enlightenment values, which started to make themselves felt in England as early as the late 16th century (Croll 1929/1969:196). The elevation of reason at the expense of emotion led to an emphasis on neutrality and objectivity, believed to be the only way to achieve conclusions that were truly universal. Hence the new prose gradually developed grammatical features (such as nominalizations and impersonal verb forms) that effectively eliminated subjectivity in order to focus upon the object of study. These will be described in more detail below.

Logical argumentation had of course been an important part of Scholastic and Humanistic education, manifested particularly in the discipline of disputatio. However, with the onset of the Scientific Revolution it gained a new inflection that had repercussions on discourse at the level of thematic progression and textual organization. This basically involved the replacement of the old system of deductive reasoning with an inductive approach, as propounded by Francis Bacon (1620/1854) in *Novum Organum*.

Aristotelian logic had largely hinged upon a device known as the syllogism, according to which a new proposition is inferred from two premises (e.g., all men are mortal; Socrates is a man; therefore Socrates is mortal). This

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1 Linguistic realism is defined by Michael Dummett (1978:146) as “the belief that statements…possess an objective truth-value independent of our means of knowing it”.
was a highly verbal kind of logic, which relied heavily upon the meanings accorded to the terms used. Bacon’s inductive reasoning, on the other hand, used repeated observations of particular instances in real life to try to arrive at generalizable conclusions. Hence, it not only shifted the focus from words to things (laying the ground for the approach to knowledge known as empiricism upon which modern science is based), but also allowed for the possibility of error. That is to say, unlike syllogistic reasoning, the premises of an inductive argument do not inevitably entail its conclusion but merely indicate the probability of it, meaning that conclusions can always be overturned if new instances come to light that disprove them. This lack of certainty is reflected in modern scientific discourse by the use of hedging devices, which allow the writer to be tentative and to avoid sweeping generalization. A decade or so prior to the publication of the first *Transactions of the Royal Society* in 1665, Robert Boyle was employing hedging devices in his scientific treatises and, at the same time, reflecting explicitly about this practice:

…in almost every one of the following essays, I…speak so doubtingly, and use so often perhaps, it seems, it is not improbable and other such expressions, as argue a diffidence to the truth of the opinions I incline to... (cited by Shapin 1984:495)

The main linguistic consequence of the shift from deductive to inductive logic derived from the need for the ‘repackaging’ of given information however. That is to say, if scientists were to build upon findings that had already been described and discussed in some detail, they had to find a way of presenting them in more concise form in subsequent references. According to Halliday and Martin (1993), the solution found to this problem was nominalization, by means of which clausal information was reformulated into a complex noun phrase. It is this regrammaticalization that underpins the scientific worldview.

1.3 *Regrammaticalization*

The most marked characteristic of modern scientific discourse is undoubtedly the density of its technical terminology. In fact, an examination of almost any stretch of scientific prose reveals that almost all the semantic content is transported by nominal elements, leaving the verbs, which are limited in range, merely to express the relationship between them (Halliday and Martin 1993:63). This conveys an image of a static world formed entirely of things (*ibid.*:15):

Where the everyday “mother tongue” of commonsense knowledge construes reality as a balanced tension between things and processes, the elaborated register of scientific knowledge reconstrues it as an
edifice of things. It holds reality still, to be kept under observation and experimented with; and in doing so, interprets it not as changing with time (as the grammar of clauses interprets it) but as persisting – or rather, persistence – through time, which is the mode of being of a noun.

According to Halliday and Martin this worldview came into being with the Scientific Revolution, and more precisely with the writings of Isaac Newton (ibid.:57-62). In an analysis of Newton’s Treatise on Opticks (published in 1704), they identify what they believe to be some of the earliest examples of nominalization, by means of which processes are systematically reconstrued as nouns through grammatical metaphorization. This compression of complex phenomena into a single semiotic entity not only enables the construction of technical taxonomies, which are of course central to the architecture of disciplines, but also permits information that has already been presented in clausal form to be concisely repackaged in order to create a discourse that moves forward by logical and coherent steps, each building on what went before. This has had important implications for the development of rational argument (ibid.:60, 63) and also for the thematic progression (internal organization) of the text as a whole (Halliday and Martin ibid.:241-55).

A second kind of grammatical metaphor that was important for the scientific reconstrual of reality is the passive, whereby the active agent in a process is suppressed to allow the focus to fall upon what would otherwise be the grammatical object. As Ding (1998) has pointed out, this transformation serves a number of different functions in scientific discourse. It has the rhetorical effect of allowing the discourse to sound objective and impersonal, which is of course central to the way in which the scientific paradigm represents the world. It also has a universalizing function by removing idiosyncrasy or doubt from results or observations, and enhances authority by implying that the result of a study does not depend upon the individual, but is replicable by any qualified scientist under similar circumstances.

Another impersonal verb form that made its appearance in English science texts at around the same time as the agentless passive is the so-called impersonal active, which Ding (ibid.:118-19) defines as the use of the active voice with “grammatical subjects that refer to objects, things, and materials”

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2 A grammatical metaphor is “like metaphor in the usual sense except that, instead of being a substitution of one word for another..., it is a substitution of one grammatical class, or one grammatical structure, for another; for example his departure instead of he departed. Here the words (lexical items) are the same; what has changed is their place in the grammar” (ibid.:79; original emphasis).

rather than to humans. Today this is extremely prevalent in English scientific discourse. Along with the passive and other impersonal verbal structures such as the anticipatory it and existential structures (i.e., there is, x happens/occurs), it was essential for reinforcing the cognitive shift set in place by nominalizations.

By the end of the 19th century, then, the grammatical structures were in place for a worldview that was set to become hegemonic in the world. The next section examines how this discourse began to be exported to other cultures and languages.

2. Exportation: the calquing process

Despite the prevalence of legitimizing myths that depict modern science as the culmination of a universal evolutionary process, this position is difficult to sustain today. Historical studies such as those described above have shown that it developed in a very particular social context, and that its discourse encodes the ideology (positivism, empiricism, linguistic realism) of the group that spawned it. Its supposed neutrality is thus no more than a linguistic construct, and the ‘universality’ that it currently enjoys might mask “a drift towards Anglo-Saxon norms” (House 2006:354), i.e., a form of cultural colonization that may ultimately result in the suppression of other ways of construing knowledge. However, with this particular kind of ‘linguistic imperialism’ (Phillipson 1992, Pennycook 1994) in most cases, the host culture actively colludes in the colonization process in order to partake of the benefits that membership of the broader discourse community will bring. Those benefits are ample. Mastery of scientific discourse not only enables researchers to participate on the international stage, bringing individual prestige, status and funding, but the close connections between science, technology and industry also mean that scientific research generates wealth for the country. Thus, there are many reasons why a country might be prepared to jettison its own traditional approach to knowledge in the context of the global economy.

As regards the time frame and transmission mechanisms involved in the exportation process, these vary considerably in accordance with host culture receptivity and conditions. For example, China seems to have begun systematically translating Western science in the second half of the 19th century.

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4 Rodman (1994) found that 73% of active structures in a corpus of science articles had subjects that refer to materials, research processes, products and the discourse and only 27% had human subjects, while Master (1991) found that 60% of active verbs either take inanimate subjects or abstract subjects.

5 Most of the early scientists were Protestants and also members of the emergent middle classes. See Merton (1938/1970/2001) on the connections between Protestantism and science.

6 This distinguishes it from the imposition of the scientific worldview that occurred during the colonial era in countries such as India (cf. Dodson 2008/2009).
in order to gain access to its technology, and by the mid 20th century, had already developed all the linguistic resources to function as an autonomous medium for scientific enquiry. That is to say, it had not only developed the capacity for nominalization considered so central for the scientific construal of reality (Halliday and Martin 1993), but had also evolved something akin to the English ‘plain style’, thereby undermining traditional attitudes towards the appropriate register for scholarship (Wright 2000/2009:282-83). By the late 20th century, according to Halliday and Martin (1993:9), it was hard to find “truly convincing differences” between the discourses of science in English and Chinese.

This contrasts markedly with the situation found in Arabic where original scientific production is extremely scarce (Campbell 2005:32). The “zero patronage” of science afforded by Arab states (Salam 1989:xi) has resulted in a situation in which “scientific discourse is a translation activity, as Arabic is usually a target language, and creation and reasoning are done in another language” (Farghal and Shunnaq 1999:210). Hence, Arab translators, who are now in increasing demand due to the rapid influx of technologies into oil-rich nations, are finding themselves effectively having to create the discourse themselves, a particularly challenging exercise given the almost total absence of any underlying frame of reference (Al-Hassnawi 2009).

With regards to European languages, it is perhaps even more difficult to establish precise time frames and directions of influence because of the close interactions that have always existed between these cultures and the complexity of the transmission mechanisms involved. However, with regard to the export of English discourse patterns, there often seems to have been two distinct stages to the calquing process: firstly an unintentional stage, where it occurs as a by-product of translation and/or imitation, and secondly, a phase where it is consciously imposed by host culture authorities through codification and education. Each of these stages is considered in more detail below.

2.1 Calquing as by-product of translation and/or imitation

Translation has historically played a very important role in the colonization of discourse, as it is often the means through which a new worldview first enters another culture. In the 12th century, for example, literalist translators calqued onto Latin not only Greek and Arabic terminology (Montgomery

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7 This is not to overlook the fact that a great deal of science had already been translated into Chinese in the Early Modern period (1552-1773) by Jesuit missionaries based in Macau (Saraiva and Jami 2008). However, Jesuit science was deeply imbued with Scholastic philosophy and embodied an essentially Christian-Aristotelian view of the world. For this reason, it is not considered here under the rubric of ‘modern’ science.

8 It was estimated that, in 1983, there were probably no more than 45,000 research and development scientists working in the Islamic world as a whole compared to 1.5 million in the USSR and 400,000 in Japan (Salam 1989: xi).
2000:148-49) but also whole grammatical structures; indeed, the first stages of the nominalization process that has proved so central to the grammar of modern scientific discourse actually unfolded in Greek, to be later transferred wholesale, first into Latin and then into the vernaculars through translation (Halliday and Martin 1993:12).

Calquing occurs when a translator makes no attempt to adapt the source text to target culture norms, but instead reproduces it literally, imposing its categories upon the target language. This inevitably produces a distortion, which initially seems unnatural to native speakers and marks out the text as a translation. Texts that result from this process have been termed ‘hybrids’ by Schäffner and Adab (1995:325):

A hybrid text is a text that results from a translational process. It shows features that somehow seem ‘out of place’/‘strange’/‘unusual’ for the receiving culture, i.e. target culture. These features, however, are not the result of a lack of translational competence or examples of ‘translationese’, but they are evidence of conscious and deliberate decisions by the translator. Although the text is not yet fully established in the target culture (because it does not conform to established norms and conventions), a hybrid text is accepted in its target culture because it fulfils its intended purpose in the communicative situation (at least for a certain time).

There are studies presently under way to determine the extent to which translation is responsible for introducing calques of English into other European languages in fields such as economics and popular science, and preliminary results suggest that its role is considerable. For example, Musacchio (2005:93) compared Italian translations of English economics articles with their originals and with ‘comparable’ original Italian texts, and concluded that the influence of English on Italian extends beyond mere lexical borrowings to pattern transfer, including compound term formation, phraseology, syntactic constructs and the use of cohesive links. House (2006, 2008) used a similar method to analyze the influence of English on popular science and economics articles in German, French and Spanish, and found that, in German particularly, communicative preferences have undergone change under the influence of English in the last 25 years (House 2006:355):

Particularly vulnerable to English influence are certain functional categories such as personal deixis, co-ordinate conjunctions and modal particles, which function as a sort of trigger for contextually induced changes in text/discourse norms in both translations and comparable texts.

In the present context of globalization, where English is the lingua franca of so many social interactions and so ubiquitously present on page and screen, it is worth considering whether translation is actually required for such changes.
to take place, or whether it might not be by-passed altogether, with discourse features entering host languages directly through a process of imitation. It is not uncommon for speakers of other languages to reproduce, consciously or unconsciously, linguistic patterns in their mother tongue that they have encountered in English, and this alone may be sufficient to bring about the kind of hybridization effect that, in previous centuries, could only have been produced by translation. Particularly in the scientific domain, where a great deal of everyday interaction takes place in English, and where new knowledge is generally acquired directly from English-language periodicals rather than through translations, imitation seems to be rife. Thus, the calques of English scientific discourse that have appeared in many European languages in recent decades seem mostly the result of scientists’ attempts to reproduce in their mother tongue patterns they have encountered in English, leading in some cases to inconsistencies, examples of which are examined in Section 4 below.

2.2 Codification

A second stage in the colonization process begins when host cultures take the initiative to actively promote the new discourse in their own language. This usually takes place through the organization of writing courses and the publication of style manuals to transmit the ‘new’ rules.

In 1976, a French medical journal commissioned the former editor of the British Medical Journal, J.A. Farfor, to diagnose why medical articles produced in France did not get published in prestigious international journals such as the BMJ and The Lancet. The result was a series of ‘lessons’ in medical writing (‘Cours élémentaire de rédaction médicale’), written in English by Farfor and translated into French by J. Feisthauer, which were published in the French medical journal, Cahiers médicaux (Farfor 1976a, 1976b). However, the project does not seem to have been very successful. Not only did readers complain that this was taking up space in the journal that could be used more profitably for clinical topics (Maisonneuve 2009:87), some actively rejected the approach as an Anglo-Saxon imposition. According to the chief editor of European Science Editing, this resistance was still present in 2009: “Medical writing has never been taught at French medical schools...the French know how to write and cannot learn these methods” (reported in Maisonneuve, ibid.).

In Portugal, in contrast, attempts to impose Anglo-Saxon scientific discourse have been more successful. Courses in ‘scientific communication’

*Farfor (1976b:224-25) describes the resistance he encountered from one particular French doctor: “After criticizing Anglo-Saxon papers for their simple language and detailed precision, he, firstly, recommended that French research should be reported in the form of ‘scholarly dissertations, with thesis, antithesis, and synthesis,’ and, secondly, renewed the classical French complaint that Anglo-Americans seem to be ignorant of French research... He concluded by appealing to French authors to defend their language by rejecting Anglo-American methods (les normes) of writing”.
or ‘scientific writing’ (escrita científica) are now often a compulsory part of postgraduate and undergraduate degree programmes, and although most are in English, some have now begun to appear in Portuguese. There are also a number of style manuals on the market teaching the precepts of this discourse in Portuguese (e.g., Ceia 1995, Serrano 1996/2004). Consequently, the kind of prose produced by scientists in Portuguese is drawing ever closer to English, to the detriment of the traditional scholarly discourse.

2.3 Receptivity/vulnerability to colonization

What, then, are the factors determining a culture’s receptivity to colonization and the extent to which assimilation takes place? Firstly, the process is obviously very dependent upon the balance of power between the cultures in question and the host language’s relative status with regard to the dominant one. As Cronin has pointed out, minority languages are particularly vulnerable and “can succumb at lexical and syntactic levels so that over time they become mirror-images of the dominant language” (1998/2010:251). Indeed, the more peripheral a language is, the more it can become a victim of its “own attempts to compensate for terminological deficiency in the present through having speedy resort to calques” (Cronin 2003:122). Conversely, a country with a confident intellectual culture of its own (such as France) is likely to resist colonization for longer.

Secondly, linguistic and cultural affinity is also likely to play an important part in determining how rapidly and thoroughly a new discourse is assimilated. Linguistic affinity will affect the ease with which this takes place; if the host language already contains the underlying resources necessary for assimilation, the process will obviously be smoother than if a whole framework needs to be created afresh. Cultural affinity, on the other hand, will affect motivation and receptivity. The fact that little original science is done in Arabic today may reflect Islamic resistance to Western values in general (Nasr n.d.), while the scientific peripherality of many Catholic countries may also be directly traceable to their Church’s traditional hostility to what was ultimately a Protestant world view. The next section focuses on these processes in operation in the concrete context of Portugal, a strongly Catholic country located on the geographical margin of Europe.

3. Discourses of knowledge in Portugal

Portuguese history since the 17th century has been marked by profound tensions between conservative and progressive political forces, with repercussions...
for all aspects of culture. From early on, the scientific paradigm became associated in the collective psyche with democracy, capitalism and progress, which meant that it was strongly resisted by those who sought to maintain traditional attachments to Church and monarchy. As those conservative forces occupied the centre of the national system for much of the country’s history, the process of assimilation of scientific discourse into Portuguese culture has not been linear but instead has been characterized by stops and starts in accordance with changing political regimes.

As a profoundly Catholic country, Portugal naturally followed the prescriptions of the Council of Trent in the context of the Counter-Reformation, maintaining Scholasticism as the academic method of choice and giving Rhetoric an important place in the curriculum long after it had been abandoned in England (Fernandes 1972). Indeed, the education system was for centuries in the hands of the Jesuits, who favoured a rich ornate style of discourse based upon a quite different epistemological premise to that underlying the English discourse of science. Like the elaborate art and architecture of the Baroque, this became something of a marker of Tridentine identity, cultivated across the Catholic world in contrast to the plain concise style promoted by the Protestants in the North (Timmermans 1999/2002, Conley 1990). Hence, verbal complexity is still valued as a marker of intellectual sophistication in Portuguese today, and the writing style taught in schools is abundant, poetic, syntactically elaborate and emotively charged.

However, there were also other voices in Portuguese society which sought to promote the scientific paradigm and the simpler style of discourse that accompanied it. Particularly influential during the 17th and 18th centuries were the ‘estrangeirados’, a heterogeneous network of Europeanized intellectuals that disseminated scientific knowledge and Enlightenment values through clandestine publications (Carneiro et al. 2000). One of the first proponents of scientific discourse in Portugal was the Oratorian friar and ‘estrangeirado’ Luís António Verney, whose work – A Verdadeira Método de Estudar (The True Method of Studying, 1711) – criticized the approach to knowledge propagated by the Jesuits and advocated a clear and simple mode of discourse in terms not unlike those used by Bacon in England a century and a half before. In the 19th century, the torch was taken up again by Antero da Quental, who challenged the canonized writing style of the day in a leaflet entitled Bom Senso e Bom Gosto (Good Sense and Good Taste, 1865). Both of these authors, in their own expository writing, used a plain style that scarcely differs from the kind of factual discourse produced today in the English-speaking world. This suggests that, in Portuguese, there were few specifically linguistic barriers to the assimilation of scientific discourse, and that the resistance incurred over the centuries was bound up more with identity issues than with language per se.

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11 This work has been credited with being one of the main forces behind the great reform of the University instituted by the Marquis of Pombal during Portugal’s brief Enlightenment between 1759 and 1772, when empirical science was formally introduced into the curriculum.
In fact, for most of its history, Portugal has been dominated by Catholic values, first through the perpetuation of the ancien régime with the support of the Inquisition (which was only finally dismantled in the 19th century) and then through the fascist dictatorship that was in power throughout most of the 20th century. There were only two very brief periods before 1974 when the scientific paradigm of knowledge acquired central status in Portugal – the period in office of the Marquis of Pombal in the 18th century and the brief Republic of 1910-1926 – and in both cases the social changes introduced were fleeting and largely reversed afterwards. Thus, the erudite ornate writing style of the humanities remained the default discourse of scholarship throughout most of the 20th century, only beginning to give way, in certain disciplines, to the more straightforward discourse of science after 1974 when the drive for economic modernization led to active promotion of the scientific mindset.

Today, the situation is complex, as was shown by a recent corpus study of the panorama of discourses produced in Portuguese academia (Bennett 2010, 2011:27-74). In total, 408 Portuguese academic texts (1,333,890 words) of different genres and disciplines were analyzed for the presence of particular discourse features not usually found in English Academic Discourse (EAD), and on the basis of this were allocated a score from 0 to -4 (called the Variance Factor or VR), reflecting their degree of deviance from the EAD model. It was found that, while the straightforward ‘modern’ style (VR 0), calqued from English, is clearly prevalent in the more scientific subjects, humanities disciplines such as history, philosophy and literary studies continue to be dominated by the more ‘traditional’ discourse characterized by complexity and erudition (VR -2). Moreover, there were in all disciplines a considerable number of ‘hybrid’ texts (VR -1) displaying characteristics of both discourses. This suggests that there is at present a certain amount of confusion amongst authors as to the ‘right’ way to write, reinforcing Schäffner and Adab’s (1995) claim that hybridity may be an intermediate stage in the colonization process.

However, the extent to which this colonization is due to translation is debatable, as I have suggested. In the field of science, at least, there is very little sign of translation activity from English into Portuguese, aside from popularizations. Instead, Portuguese scientists seem to acquire their disciplinary knowledge directly through English, using English-language textbooks and periodicals, and attending English-language conferences. Hence, the calquing that has

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12 These included complex sentences; verbless sentences; high-flown or poetic diction; embedding devices; deferred topic; abstractions; historical tenses, and certain uses of the gerund and personal pronouns. General translatability was also taken into account.

13 There was also evidence of an even more alien ‘postmodern’ discourse in some arts and humanities subjects (VR -3 and -4), marked by features such as wordplay, neologisms, paradoxes, etc, of the kind favoured by Derrida and other poststructuralists.

14 That is to say, academic libraries and databases contain virtually no Portuguese translations of scientific works, and are instead dominated by texts in English and other European languages.