



CUADERNOS DE TRABAJO

FACULTAD DE ESTUDIOS ESTADÍSTICOS

The polemic but often decisive contribution
of computer science to linguistic and
statistical research on translation accuracy
and efficiency

Antonio Níguez Bernal

Cuaderno de Trabajo número 01/2015



UCM

UNIVERSIDAD
COMPLUTENSE
MADRID

Los Cuadernos de Trabajo de la Facultad de Estudios Estadísticos constituyen una apuesta por la publicación de los trabajos en curso y de los informes técnicos desarrollados desde la Facultad para servir de apoyo tanto a la docencia como a la investigación.

Los Cuadernos de Trabajo se pueden descargar de la página de la Biblioteca de la Facultad www.ucm.es/BUCM/est/ y en la sección de investigación de la página del centro www.ucm.es/centros/webs/eest/

CONTACTO:

Biblioteca de la Facultad de Estudios Estadísticos

Universidad Complutense de Madrid

Av. Puerta de Hierro, S/N

28040 Madrid

Tlf. 913944035

buc_est@buc.ucm.es

Los trabajos publicados en la serie Cuadernos de Trabajo de la Facultad de Estudios Estadísticos no están sujetos a ninguna evaluación previa. Las opiniones y análisis que aparecen publicados en los Cuadernos de Trabajo son responsabilidad exclusiva de sus autores.

ISSN: 2341-2550

The polemic but often decisive contribution of computer science to linguistic and statistical research on translation accuracy and efficiency

Antonio Níguez Bernal
Universidad Complutense de Madrid
antonioniguez@yahoo.es

ABSTRACT

Nowadays, most countries are negatively affected by the disgusting nightmare of world economic crisis, the increasing menacing rate of unemployment and the newly unpredictable era of international globalisation. Unfortunately, at the beginning of the XXI century, we are just deeply immersed in sometimes apocalyptic war, social-economic and geological conflicts (Ukraine-Russia, Israel-the Gaza Strip, the Islamic State, Libya, Syria, Egypt, Greece, the alarming growing number of immigrants from less developed countries, the 'ebola' epidemic, the dantesque earthquakes in Nepal ...). However, fortunately, we are also at the threshold of many positively recognized revolutionary changes in the wide field of politics, economics, medicine, computer science, statistics, traductology/translemics and the solid impact of modern mass media.

Moreover, highly sophisticated laptops, palmtops, tiny smartphones, Smart TVs., ipods, tablets and several very useful computer devices keep working at incredible speeds although always obeying human instructions. Furthermore, some well-known scientists still try to provide them with artificial intelligence, so that they behave like real human beings, perhaps ignoring that worldwide experts already agree that such utterly challenging idea may be practically unattainable.

The empirical-scientific purpose of this article is focused on showing the polemic reliability of a few modern 'machine translators' available in the Internet: firstly, pointing out that some of them provide us with better results than others and, secondly, trying to highlight the fact that, even if specific advanced technology is used in this process, countless scientific and literary texts are not yet accurately translated.

Key words: computer science, statistical structure, traductology/translemics, artificial intelligence, polemic reliability, machine translators.

RESUMEN

Hoy en día, la mayoría de los países se encuentran negativamente afectados por la terrible pesadilla de la crisis económica mundial, la tasa amenazadora creciente del paro y la nueva e imprevisible era de la globalización internacional. Desgraciadamente, a principios del siglo XXI, nos hallamos completamente inmersos en conflictos bélicos, socio-económicos y geológicos, a veces apocalípticos (Ucrania-Rusia, Israel-Palestina, el Estado Islámico, Libia, Siria, Egipto, Grecia, el incremento alarmante en la cifra de inmigrantes procedentes de países menos desarrollados, la epidemia del ébola, los terremotos dantescos de Nepal...). Sin embargo, afortunadamente, también estamos en el umbral de muchos cambios revolucionarios positivamente reconocidos en el vasto ámbito de la política, la economía, la medicina, la informática, la estadística, la traductología/translémica y el firme impacto de los modernos medios de comunicación.

Además, ordenadores portátiles altamente sofisticados, los de mano, diminutos smartphones, Smart TVs, ipods, tablets y varios artilugios informáticos de suma utilidad continúan funcionando a velocidad de vértigo, aunque siempre obedezcan a

instrucciones dadas por el hombre. Por otra parte, algunos científicos de reconocido prestigio todavía intentan dotarlos de dicha inteligencia artificial, de modo que puedan comportarse como seres humanos reales, tal vez ignorando que expertos internacionales ya están de acuerdo en que idea tan sumamente retardadora puede resultar prácticamente irrealizable.

El propósito empírico-científico de este artículo se centra en mostrar la polémica fiabilidad de unas cuantas ‘máquinas traductoras’ modernas disponibles en Internet: resaltando, en primer lugar, que algunas nos proporcionan mejores resultados que otras y, en segundo lugar, poner de manifiesto el hecho de que, incluso si en este proceso se utiliza tecnología avanzada específica, incontables textos científicos y literarios siguen sin traducirse de forma correcta.

Palabras clave: ciencia informática, estructura estadística, traductología/translémica, inteligencia artificial, fiabilidad polémica, máquinas traductoras.

Summary: 1. Introduction. 2. The statistical structure of language. 3. Computer-assisted language learning and translating activities: theoretical background. 4. Some common difficulties both in machine translators and idioms. 5 The strategic linguistic-statistical-empirical methodology used in this research. 6. Definite machine translators’ risky results obtained from both scientific and literary extracts. 7. Conclusions. 8. Appendixes.

1. Introduction

The English term ‘translation’, first attested in around 1340, was used by the religious hermit and scholar Richard Rolle (c. 1310-1349) in the Preface of his *Psalter* (Oxford English Dictionary, on line). This word derives either from old French ‘translation’ or more directly from the Latin ‘translatio’ (‘transporting’), itself coming from the participle of the verb ‘transferre’ (‘to carry over’). The Spanish linguist A. H Albir reminds us, in *Translation and Traductology* (2001:4), that “back in history, Herodotus already mentioned the importance of interpreters and translators in Ancient Egypt”, making a clear distinction between ‘translation’ and ‘traductology’. For her, ‘translation’ is “a specific sort of skill, a *know-how* that makes us able to succeed when going through the translating process, and our ability to solve different problems that may appear in that process”, whereas ‘traductology’ is “a new science whose concern is mainly studying translation and knowing about the translating practice”.

J.C.Richards, in *Longman Dictionary of Language Teaching and Applied Linguistics* (1993:389), points out that “translation is the process of changing speech or writing from one language (the ‘source language’) into another (the ‘target language’), or the ‘target-language version’ that results from this process”. Today, we can perceive an emerging new concept of literary, scientific and technical translation, integrating both discursive and cultural elements: therefore, translators must take into account some new approaches based not only on words, sentences and texts, but also on discourse and cultural background. J. Munday, in *Introducing Translation Studies. Theories and Applications* (2012: 9), states that “translation has several meanings: a) the general subject field (‘I studied translation at university’); b) the product –the text that has been

translated ('They published the Arabic translation of the report'); and c) the process of producing the translation, otherwise known as 'translating' ('Translation service')".

For D. Crystal, in *The Cambridge Encyclopedia of Language* (2011:354), "the aim of translation is to provide semantic equivalence between source and target language; this is what makes translation different from other kinds of linguistic activity, such as adapting, *précis* writing, and abstracting". Several types of translation have been proposed so far: in a '*pragmatic*' translation, the emphasis is entirely on accuracy and knowledge of the subject, as required for instructional manuals and much scientific research. In an '*aesthetic*' translation, important for literary material, the focus is on preserving the emotional cognitive content of the work, as well as maintaining some stylistic equivalence. '*Ethnographic*' or '*sociolinguistic*' translations aim to pay full attention to the cultural backgrounds of the authors and the recipients, and to take into account differences between 'source' and 'target' language, as when Christian religious traditions based in the Middle East are 'translated' into the cultural norms of Central Africa or modern-day America. To sum up, there are various kinds of '*linguistic*' translation, where the aim is to convey the structural flavour of the original text, often in a quite literal manner, emphasizing such features as archaisms, dialectisms, and levels of formality.

Finally, my real purpose when writing this paper, has been focused on the efficient way and possibility of translating some standard and relevant texts of literary and scientific-technical prose, with a view to solving several difficulties of what I consider a '*new interdisciplinary approach*', paying attention to the impact and influence of some recent outstanding advances in the fields of linguistics and statistical studies. Furthermore, to verify and improve my research, I have rigorously consulted different disciplines involved in the general process of translation and interpretation, revising the important item of 'computer-assisted translation', as well as adding my survey of 'machine translators' and their polemic, although sometimes decisive, impact on translation reliability and accuracy.

2. The statistical structure of language

Sheldon M. Ross, in *Introductory Statistics* (2010:7-9), affirms that "a systematic collection of data on the population and the economy was begun in the Italian city-states of Venice and Florence during the Renaissance...The term '*Statistics*', which was used until the 18th century as a shorthand for the descriptive science of states, in the 19th century turned out to be increasingly identified with numbers...In the late 1800s '*Statistics*' became concerned with inferring conclusions from numerical data". Nowadays, *Statistics* is strongly connected with several branches of knowledge: '*Descriptive Statistics*', featured in every newspaper and magazine; '*statistical inference*', indispensable to public health and medical research, marketing and quality control, computer science, education and the teaching of modern languages, economics, meteorological forecasting, polling, sports, and all scientific research ingrained in our intellectual heritage.

Jean-Pierre Beaud, in *La Statistique et la Politique, Historia de la Probabilidad y la Estadística* (2014:137), points out that "c'est à compter du XIXe siècle que les États organisent la collecte de données statistiques...On peut distinguer l'étape de la '*nationalisation statistique*' qui correspond à la mise en place des bureaux statistiques permanents (du milieu du XIXe siècle aux années 1930-1940), celle du '*keynésianisme statistique*' qui voit l'édification des comptes nationaux, et celle du '*néolibéralisme*'

statistique' (à compter des années 1980) qui se caractérise par une plus grande attention portée aux statistiques permettant d'évaluer l'efficacité des politiques étatiques".

'*Statistics*' in the XXI century is a scientific discipline concerned with collection, analysis, and interpretation of data obtained from observation or experiment. Besides, using a metaphor, we can really affirm that '*Statistics*', widely recognized as an independent science although closely connected with Mathematics, can be summarized as 'the true art of learning from data'. As regards any level of linguistic structure, it is possible and has been scientifically proved that we can count the different units that occur, and then link together the frequencies that we have obtained, to see if there are any '*statistical regularities*' governing their use. Many aspects of grammar, vocabulary, sound and writing systems have been studied in this way and, as a result, interesting patterns have emerged, proposing some *statistical properties* that appear in all languages as statistical '*laws*' or '*universals*'.

'*Statistical regularities*' are independent of speaker, writer or subject matter and we are free to say whatever we want: in practice our linguistic behaviour conforms closely to several *statistical expectations*. We can affirm that if we write a *q* in English, it is going to be followed by *u* (though not always, because of *Iraq* and other exceptions). Less obviously, it emerges that just over 60% of everything we say will be made up of consonants, and just under 40% of vowels; about a third of all the syllables we use in everyday speech will have the structure of consonant + vowel + consonant, as in *cat*; and the 50 most commonly used words in the language will make up about 45% of everything we write.

D. Crystal, in *The Cambridge Encyclopedia of Language*, states that "the remarkable thing about such facts is that, while we are engaged in communication, we do not consciously monitor our language to ensure what these statistical properties obtain. It would be impossible to do so. Yet, without any deliberate effort on our part, we will find the same underlying regularities in any large sample of our speech or writing; the study of these regularities, and of the factors that constrain them, is the province of *statistical linguistics*" (2011: 90). One of the simplest demonstrations of '*statistical regularity*' within a language is the '*frequency of occurrence*' of the letters of the alphabet. Take a text, in any language, and count the words; then, order them in terms of decreasing frequency: according to one statistical prediction, the first 15 words will account for 25% of the text, the first 100 words for 60%; the first 1000 for 85%, and the first 4000 for 97.5%. Thus, we can conclude that in short samples considerable variations from these proportions will be found..

There is an inverse relationship between the 'length' of a word and its 'frequency': in English, for example, the majority of the commonly used words are monosyllables. The same relationship exists in German, which has a marked 'polysyllabic' vocabulary. This effect seems to account for the British tendency to abbreviate words when their frequency of use rises: e.g. the routine reduction of '*microphone*' to '*mike*' by radio broadcasters. It would also seem to be an efficient communicative principle having the popular words short and the rare words long. On top of that, there is an apparent equilibrium in English between diversity and uniformity in its use of sounds and words: the simpler the sound the shorter the word and more often used by human beings.

3. Computer-assisted language learning and translating activities: theoretical background

The use of computers in modern society is a clear example of the amazing changes the world has undergone in recent years. Accelerated by the development of the silicon chip, today's computers have become more powerful, smaller, less expensive and more widely available. Currently, sophisticated laptops, electronic mails, chatgroups, virtual worlds, World Wide Web, instant messaging, blogging, texting, voice over Internet, social networking, mobile phones, smartphones, Smart TVs, tablets and many other technological computer devices succeed in getting people closely connected all over the world. Nevertheless, we must not either ignore that robotics and computer science can also create unemployment replacing many industrial workers, those who in the past were hopelessly struggling to make a miserable living with repetitive unrewarding tasks and negative far-reaching side effects.

In only a short period of time, computer science, high technology and robotics have profoundly changed the way in which many kinds of work are done, offering their valuable tools to statisticians, linguists, translators and interpreters in many worldwide official institutions. Indeed, they have created whole new areas of work: we have all heard of computers plotting the course of rockets, designing war strategies in international conflicts, helping doctors in hospitals, figuring out bank statements, predicting elections and chaotic immigration events, forecasting the weather and being extremely helpful in many of our daily tasks. Obviously, computers can solve endless problems that would be a nightmare for us if we did not have them: e.g., they usually take some of our routine activities and finish them in a split second, in a shorter time than it would take many men to accomplish them, although we must not forget that they can also create unemployment.

Despite the scientific basis of computers, some inhabitants in less developed countries are still awed by their magic way of functioning, by their quick performance of serious difficult operations. In those countries, illiterate people still keep imagining that computers are only huge wizard adding machines, but evidently that is a very restricted view of their sophisticated technical nature. Nowadays, many of us still look at computers with respect on account of their fabulous efficient results, though we should never believe that machines are, as a whole, wiser than men, or simply that a car can be more intelligent than its owner just because it travels at several miles an hour.

Ken Beatty, in *Teaching and Researching Computer-Assisted Language Learning* (2010: 9), points out that "computer-based language functions are already integrated into word processing, e-mail and other software that corrects spelling and grammar, offers thesaurus functions and even cautions against the use of what it perceives as hostile or profane language". I am sure that, just about a century ago, this idea was probably ignored by a child at school opening an atlas of the world, gazing over large portions of it labelled *terra incognita*. For some scholars, the opinion of so much of the world being in the realm of the unknown would have been a compelling invitation to exploration, whereas, for others, less adventurous, the excitement would simply mean refining the edges of the map, more clearly understanding details and charting the unavoidable future changes.

What is mentioned in the paragraph above is very much alive today in a new area: that of '*Computer-Assisted Language Learning*' (CALL), which is filled with spaces that are unknown and in need of being analyzed. Even where much is clear, more research has to be done on specific details as other factors and conditions change, such as the introduction of new technologies (K.Beatty:1). Using computers for translation

activities is often referred to as '*Computer-mediated communication*' (CMC), one of the most popular activities associated with CALL: for K. Beatty (2010: 69), "CMC encompasses communication by e-mail, bulletin boards, chat lines, within MOO (*Multi-user domains, Object Oriented*) environments and using social networking services such as Face Book and Twitter".

W. J. Hutchins and H. L. Somers, in *An introduction to machine translation* (1992: 2), state that "the term '*machine translation*' applies to computerized systems responsible for the production of translation with or without human assistance". There is a distinction between '*human-aided MT*' and '*machine-aided human translation*': the latter comprises computer-based translation tools which support translators by providing access to on-line dictionaries. The term '*computer-aided translation*' is used to cover all the '*computer-based translation systems*'. Both authors (1992: 502-503) declare that "although the ideal goal of machine translation systems may be to produce high-quality translation without human intervention, in practice this is not possible except in highly constrained situations". Nevertheless, the translation quality of machine translation systems may be improved by adjusting, editing or controlling the input; moreover, translators must be aware that machine translation systems can be designed either specifically for two particular languages, called '*bilingual systems*', or for more than a single pair of languages, '*multilingual systems*'.

Many '*machine translation systems*' have problems with unknown words and unanticipated combinations: thus, morphological analysis often includes the segmentation of compounds, but this segmentation can sometimes be a drawback. Hutchins' opinion (1992: 509-510) is that '*MT systems*' are not suitable to be used by professional translators, who frequently prefer computer aids being under their full control. In the past, an early '*computer-based aid*' was the provision of text-related glossaries produced by matching individual words or a specific text against an existing bilingual terminology database. Since the 1980s, '*translation memory*' has become an invaluable tool, integrating various machine translation systems in the translator workstation for producing good quality machine-aided translations.

For D. Robinson, in *Becoming a translator: an accelerated course* (1997: 6), "a text reliability consists in the trust a user can place in it, or encourage others to do so, as a representation or reproduction of the original", whereas E. H. Hovy states that "human evaluations of machine translation weigh many aspects of translation, including adequacy, fidelity and fluency". According to Papineni, Roukos, Ward and Zhu in "A Method for Automatic Evaluation of Machine Translation". *Proceedings of the 40th Annual Meeting of the Association for Computational Linguistics (ACL)*. Philadelphia. (2002:311), "the closer a machine translation is to a professional human translation, the better it is". As a whole, there is general agreement about the basic features of machine translation (MT) evaluation reflected in general introductory texts (Lehrberger & Bourbeau, 1988; Hutchins & Somers, 1992; Arnold et al.,1994), but there are no universally reliable methods and measures, whereas evaluation methodology has been the subject of much discussion in recent years. Finally, my survey raises the following question: are computers a real useful helping tool for professional translators and, therefore, can they produce real accurate translations?

David Crystal, in *The Cambridge Encyclopedia of Language* (2011:360), points out that "the idea of using machines to provide translations between natural languages has been recognized since the 1930s, but an appropriate climate for development did not arise until the years following World War II...However, initial results were not encouraging....The main reason was the lack of a sufficiently sophisticated theory to provide a frame of reference for the tasks that machine translation needed to undertake".

Outstanding recent developments have provided systems of analysis that allow for grammatical and semantic complexity; the first steps were in devising automatic procedures ('algorithms') for parsing the syntactic structure of a sentence, and for implementing an analysis of word structure. Later advances have introduced semantic information into the procedure, using artificial intelligence techniques to simulate human thought processes ('knowledge-based machine translation'). Computers, like human readers, should use inference routines, and look back at the preceding discourses in order to check their interpretations of a specific matter. Finally, recent special programming languages, designed to handle the properties of natural language in a more direct way, are facilitating the task, but it will probably take a long time before we can appreciate the pure research results in routine commercial applications.

4. Some common difficulties both in machine translators and idioms

Mona Baker, in her book *In other words. A course on translation* (2011:71), affirms that "once an idiom has been recognized and interpreted correctly, the next step is to decide how to translate it into the target language. The difficulties involved when using machine translators to translate idioms are totally different from those interpreting them". Nevertheless, I believe that the question is not whether a given idiom is transparent, opaque or misleading for the machine translator, due to the fact that an opaque expression may be much easier to translate than what we consider a transparent one. I really think that using idioms, in English and in other modern languages, is usually something concerning style in most cases and circumstances.

Some languages, such as Arabic and Chinese -which usually draw a sharp distinction between written and spoken discourse, and whose written mode is associated with a high level of formality-, tend to avoid using idioms in written texts. In this respect, linguists F.Chitra and R.Flavell, in their book *On Idiom: Critical Views and Perspectives* (1981:85), wisely analyze the differences and rhetorical effects of using idioms in the 'source' and 'target language', concluding that "translation is an exacting art, and idioms, more than any other feature of language, demand that translators, as human beings, or perhaps, more unlikely, machine translators, be extremely accurate and highly sensitive to the rhetorical nuances of the language".

For W.J.Hutchins (1992:501-503), "the term 'machine translation' refers to computerized systems responsible for the production of translations with or without human assistance....very often, machine translators cannot deal with an accurate translation of idioms because they are not human and lack the skilfulness to translate them". Therefore, translators must be very careful even with sophisticated computers because they can make different mistakes, mainly those concerning determiners, pronouns, nouns, adjectives, prepositions, verbs, conjunctions, concordance and non translated words, which can be chaotic when translating complex idioms.

Justine Brehm Cripps, in *Targeting the Source Text: A Coursebook in English for Translator Trainees* (2007:11), declares that "translation scholars and teachers point out today that the storehouse of skills and knowledge, characteristic of professional translators, must include a solid background in the lexical, grammatical, discursive and sociolinguistic aspects of source and target languages, as well as literacy in computer science and machine translators". I deeply agree with that statement, but it is also true that it is very difficult for machine translators - as Manuel Alvar mentioned in several of his late articles- to cope successfully with the correct translation of 'false friends' and 'idioms', as well as effectively considering their nuances and meanings to be transferred into target language.

To sum up, I consider that translation really begins and ends with language: where the ‘source language’ (or language of the text-to-be-translated) is concerned; besides, translators should be extremely skilful and cautious at interpreting textual meaning to re-express it in all its nuances in the ‘target language’. As a matter of fact, to avoid serious problems, they should be highly qualified to be able to deal with all kinds of complex literary and scientific texts, whereas, as I said before, I believe that *machine translators*, despite their sophisticated developed technology, will be less efficient and accurate due to their absolute lack of human independence and intelligence.

5. The strategic linguistic-statistical-empirical methodology used in this research

So far, I have focused my attention on a wide survey concerning the questionable reliability of several computer translators available on line for professional people. My other main objective has been to show which of those machines could provide better translations, as well as which scientific or literary texts were more able to be effectively translated. To reach my goals, I have worked with what I call a ‘*strategic linguistic-statistical-empirical methodology*’, using five machine translators: a) SYSTRAN (web page: www.wywtrnsoft.com.); b) Alta Vista (web page: <http://babelfish.altavista.com>.); c) Google (web page: www.google.translation.com.); d) Free translation (web page: www.freetranslation.com.); and e) The on-line translator Wordlingo (web page: www.wordlingo.com.).

As regards my sources of information, I have thoroughly consulted two scientific texts concerning Alzheimer, a seriously increasing disease in our century, and two literary extracts from Victorian novels. The medical texts ‘Alzheimer and Dementia’ and ‘Another Dead End for Alzheimer’s Drug’, were selected from web page www.guardian.co.uk. The first literary extract has been taken from the initial part of Chapter One of *Whuthering Heights*, by Emily Brontë, whereas the second one is from the beginning of Chapter One of *Jane Eyre*, by Charlotte Brontë; both from web page www.gutenberg.org.

My experimental design has been based on the translation of those two scientific texts and literary English extracts into Spanish. For accomplishing that task I selected the five already mentioned computer translators, introducing in them the four different pieces of text, and right after that the translations into Spanish. The next step was analyzing those translations with a view to testing which computer translator was more accurate, proving the texts which were better translated and classifying the errors into the following categories: determiners, prepositions, verbs, pronouns, nouns, adjectives, adverbs, concordances, conjunctions and punctuation mistakes.

I fervently recommend translators to implement some ‘*strategic linguistic-statistical-empirical methodologies*’, putting them into practice when dealing with difficult translations in specific cases, for they will surely help them a lot to translate international scientific articles, technical texts and sophisticated literary prose. Eventually, acting like that, either in international institutions or in large multinational companies, they will become more efficient in their professional lives, getting rewarding challenging opportunities and better attractive contracts with higher salaries and probably far-reaching promotion perspectives.

6. Definite machine translators' risky results obtained from both scientific and literary extracts

In my research, the most common mistake found in *medical text results* has been the *incorrect use of determiners*: the five machine translators translated the utterance 'Alzheimer destroys' as 'Alzheimer destruye', whereas the correct translation should have been 'el Alzheimer destruye'. Furthermore, SYSTRAN, Alta Vista and Free translation interpreted 'brain disease' as 'enfermedad de cerebro', instead of 'enfermedad del cerebro'. Besides, the utterance 'vascular dementia, mixed dementia, dementia with Lewy bodies and frontotemporal dementia', became 'demencia vascular, demencia mezclada, demencia con los cuerpos de Lewy y demencia frontotemporal' according to all machine translators, instead of 'la demencia vascular, la demencia mezclada, la demencia con los cuerpos de Lewy y la demencia frontotemporal'.

My *empirical-linguistic-statistical study* has also revealed that *preposition errors* are very frequent when using computer translators: e.g., the utterance 'Alzheimer has been confounding drug makers' was translated as 'Alzheimer ha estado confundiendo traficantes', however, I suggest: 'el Alzheimer ha estado confundiendo a los laboratorios'. On top of that, the five machines translated 'other intellectual abilities serious enough to interfere with daily life' as 'otras capacidades intelectuales bastante serias interferir con vida de cada día', when it should have been 'otras capacidades intelectuales lo bastante serias/graves como para interferir en la vida diaria'.

The previous results let us confirm that *verb mistakes* are frequent in the Spanish translation: as an example, the utterance 'the words of Benjamin Franklin who said', translated by SYSTRAN and Alta Vista as 'las palabras de Benjamín Franklin que dijeron', producing Wordlingo 'las palabras de Benjamin Franklin que dicho'; instead, I am in favour of 'las palabras de Benjamín Franklin que/quien dijo' as the best translation. Moreover, several *noun translations* are quite inefficient: for instance, the noun 'drug' is taken as 'droga', when it should be 'medicamento' o 'fármaco', and the noun 'fitness', in 'brain fitness', is wrongly translated as 'aptitud' by SYSTRAN and Alta Vista, instead of 'salud mental'; besides, the word 'fitness' is translated by Google as 'fitness', when, in Spanish, it should be 'salud'. Finally, Google, Free translation and Alta Vista also make some *conjunction errors*: for instance, the symbol '&', meaning 'and', that appears in the English text remains just the same in the Spanish version.

As far as the *literary texts* are concerned, I have realized that one common error is the incorrect use of *determiners*: for example, the utterance 'in all England' is translated as 'en toda la Inglaterra' by SYSTRAN, ALTA Vista, Free translation and Wordlingo, when it should be 'en toda Inglaterra'. For SYSTRAN and Alta Vista 'and Mr. Heathcliff' is 'y sr. Heathcliff', instead of 'y el sr. Heathcliff'. Google provides the translation 'cuando su los dedos' for 'when his fingers', rather than 'cuando sus dedos'; in addition, 'was uttered with closed teeth' is translated by Free translation, as 'fue pronunciado con dientes cerrados', when it should be 'se pronunció con los dientes apretados'. Also, for SYSTRAN, Wordlingo and Alta Vista 'that day' is 'que día', instead of 'ese día'; and, 'but since dinner' is 'pero puesto que cena' for Systra and Alta Vista, when 'pero desde la cena' would be far more accurate. Eventually, SYSTRAN, Alta Vista and Wordlingo translate 'Eliza, John and Georgiana' as 'al Eliza, al Juan y el Georgiana', when 'Eliza, John y Georgiana' is a much better translation.

Verb mistakes are also very frequent in machine translators: firstly, the utterance 'that I shall be troubled with' is translated as 'me preocuparán con', by SYSTRAN, Alta Vista and Wordlingo, and as 'que se turbará con', by Google; in my opinion, it should have been 'con quien tener problemas'; secondly, the past tense 'imagined' becomes

'imaginada' by SYSTRAN, 'imaginado' by Alta Vista and 'imaginar' by Google, when 'imaginaba' is the correct translation. As regards *prepositions* some translations are not equally accurate: e.g., the preposition 'with' in the utterance 'the solitary neighbour that I shall be troubled with' is translated into Spanish at the end of it, when it should be 'el vecino solitario con quien tendré problemas', placing the preposition before the relative pronoun; finally, 'under their brows', for Google is 'en la frente', instead of 'debajo de sus cejas'.

I have also come across some serious *pronoun mistakes*: e.g., 'I do not believe that I could have fixed' is translated as 'no creo que habría podido fijar', instead of 'no creo que me habría podido fijar'; for SYSTRAN, Alta Vista and Free translation 'I felt interested' is 'sentía interesado', when I recommend 'me sentí interesado'. Furthermore, I have noticed that *some words are frequently omitted* in several translations: the words 'stir', in the utterance 'from the stir of society', and 'misanthropist' are not translated by SYSTRAN; eventually, Worldlingo omits the words 'desolation', 'suspiciously', 'sympathising' and 'exaggeratedly'.

I have equally found out some *concordance and adverb mistakes*: 'his black eyes' translated as 'sus ojos negro' by Google, when it should be 'sus ojos negros'. In addition, Google translates 'when his fingers' as 'cuando su los dedos', instead of 'cuando sus dedos'. Related to adverb mistakes, the sentence 'I heard yesterday you had some thoughts' is translated as 'el que ustedes habían tenido ayer algunos pensamientos', instead of 'oí ayer que ustedes habían tenido algunos pensamientos'. In the field of *noun and adjective mistakes*, the nominal group 'their brows' turns out into 'sus frentes' by SYSTRAN, Alta Vista, Free translation and Worldlingo, and as 'la frente' by Google, when I simply recommend 'sus cejas'. Then, 'Georgiana Reed' is interpreted as 'a la caña de Georgiana' by SYSTRAN, Alta Vista and Worldlingo, when, being a surname, should not be translated.

As regards *adjective errors*: 'reserved' is translated as 'reservo' by Free translation, instead of 'reservado'; the utterance 'his black eyes' becomes 'sus ojos morados' with SYSTRAN, Alta Vista and Free translation, when it should be 'sus ojos negros'. I have also noticed some *utterance mistakes*: for example, 'Thruscross Grange is my own' translated as 'el granero de Thruscross es mi el propio' by SYSTRAN and Alta Vista, and as 'Thruscross Grange es mi propio' by Google, Free translation and Worldlingo, instead of 'Thruscross Grange es de mi propiedad'.

In the field of *medical texts*, the most common mistakes made by all five machine translators were those concerning the *incorrect use of determiners, verbs, prepositions, concordances, nouns, utterances and punctuation mistakes*. Google did not translate the word 'fitness' into Spanish, as I mentioned before, whereas Google, Free translation and Alta Vista made several conjunction mistakes. Finally, in *literary extracts*, I have realized that the most relevant problems were those related to *determiners, verbs and prepositions*. Moreover, machine translators constantly failed when dealing with *pronouns, non translated words, concordances, adverbs and nouns*, and all of them made very similar mistakes in medical and literary texts.

7. Conclusions

One of the main purposes of this paper has been focused, on the one hand, on presenting a '*strategic linguistic-statistical-empirical survey*' of some machine translators available in the Internet, highlighting their polemic reliability when being used by professional translators; on the other hand, on trying to show their common deficiencies when translating scientific and literary English texts into Spanish. My

findings have equally revealed that SYSTRAN, Alta Vista, Google, Free translation and Wordlingo usually make different kinds of mistakes related to determiners, pronouns, nouns, adjectives, prepositions, verbs, conjunctions, concordances and non translated word errors. Bearing all those drawbacks in mind, I do encourage future researchers to carry out serious investigation with a view to helping translators and interpreters in their professional lives, avoiding them many chaotic discouraging results.

In my opinion, it seems very unlikely, although not impossible, that new highly sophisticated machines will absolutely replace human translators, as the British writer George Orwell predicted in his famous novel *1984*, where he described a desperate future under totalitarian political regimes. Nevertheless, we have to recognize that they take a great deal of the drudgery out of routine translation work: as a matter of fact, some systems can nowadays process quantities of text in certain areas at astonishing rates of up to 10000 words per hour. We must also bear in mind the rapidly developing world of 'machine-aided translation', the proper use of computationally organized data banks as well as recently updated peripheral equipment.

Nowadays many people agree that the benefits of machine translators (MT) clearly outweigh their disadvantages, and this in turn adds to the mood of optimism that pervades the current MT polemic debate. On top of that, newly efficient global techniques are quickly established: incorporating the results of post-editing experience into the system; using inductive techniques of pattern-matching and probability to provide an MT system with a knowledge-base derived from real texts; and devising 'sublanguages', with reduced syntax and lexicon, so that texts can be prepared to work within the constraints of a system (e.g. the notions of '*restricted language*' and '*Nuclear English*').

For a long time the MT ('*Machine Translation*') world has been quite a small one, with few research programmes. Nevertheless, that dramatic situation is rapidly changing. I deeply agree with W.J. Hutchins (1992: 502-506), when he states that "although the ideal goal of MT systems may be to produce high-quality translation without human intervention at any stage, in practice this is not possible except in extremely constrained situations". I would like to add that once I have come across the various types of errors made by machine translation systems, I have also noticed that they really differ from those made by human translators (i.e., incorrect prepositions, articles, pronouns, verb tenses...), and that most machine translation systems, as M. Alvar pointed out, have had serious problems when translating new foreign words.

Finally, I only wish and hope that my research can help other linguists, statisticians, physicians, interpreters and translators to understand that *machine translators are not always reliable*, but we should not ignore that there are also many excellent exceptions. To sum up, I sincerely recommend investigators to get on enthusiastically with their rigorous scientific and linguistic-statistical research, using updated translation strategies and techniques, encouraging them to be aware that both computer literacy and interdisciplinary knowledge can be accurately 'interpreted' and 'translated'. Of course, their main purpose should be providing useful translation tools for the final benefit of international institutions, publishing companies, worldwide university professors and students, honest politicians and people from different professions, thus successfully contributing to achieve international peace, mutual understanding among nations and a most prosperous predictable future for mankind.

8. Appendixes

In my ‘*empirical-statistical-linguistic computer translation survey*’, the following medical and literary texts have been used: “Alzheimer and Dementia. Another Dead End for Alzheimer’s Drug” and Chapter I of novels *Wuthering Heights*, by Emily Brontë, and *Jane Eyre*, by Charlotte Brontë.

Alzheimer and Dementia. Another Dead End for Alzheimer’s Drug

Alzheimer is a progressive and fatal brain disease that currently has no foreseeable cure, outrageously destroying brain cells, causing chaotic problems with memory, thinking and behaviour; its effects can be severe enough to impair a person’s ability to work, play and interact with family and friends. It is the most common form of dementia, a general term for the loss of memory and other intellectual abilities, serious enough to interfere with daily life. Other types of dementia are ‘vascular dementia’, ‘mixed dementia’, ‘dementia with Lewy bodies’ and ‘frontotemporal dementia’.

So far, Alzheimer has been confounding many drug makers, but recently pharmaceutical giant Eli Lilly & Co. is in the late stages of developing a promising experimental drug that may be an excellent antidote against the disease. As our population lives longer we need real effective low-cost treatments, and that is one of the reasons why international laboratories continue searching for better drugs. Eventually, it may be wise to consider Benjamin Franklin’s words: ‘An ounce of prevention is worth a pound of cure’. Therefore, what can we do to reduce the horrible nightmare of dementias?: decades of brain fitness research have shown that participating in rigorous cognitive activity over time is linked with an up to 63 percent reduced risk of developing Alzheimer’s disease.

Chapter I of Wuthering Heights

I have just returned from a visit to my landlord –the solitary neighbour that I shall be troubled with. This is certainly a beautiful country! In all England, I do not believe that I could have fixed on a situation so completely removed from the stir of society. A perfect misanthropist’s heaven: and Mr. Heathcliff and I are such a suitable pair to divide the desolation between us. A capital fellow! He little imagined how my heart warmed towards him when I beheld this black eyes withdraw so suspiciously under their brows, as I rode up, and when his fingers sheltered themselves, with a jealous resolution, still further in his waistcoat, as I announced my name.

‘Mr. Heathcliff?’ I said.

A nod was the answer.

Mr. Lockwood, your new tenant, sir. I do myself the honour of calling as soon as possible after my arrival, to express the hope that I have not inconvenienced you by my perseverance in soliciting the occupation of Thrushcross Grange: I heard yesterday you had had some thoughts.....’

Thrushcross Grange is my own, sir’, he interrupted, wincing. ‘I should not allow anyone to inconvenience me, if I could hinder it....walk in!’

The 'walk in' was uttered with closed teeth, and expressed the sentiment, 'Go to the Deuce', even the gate over which he leant manifested no sympathising movement to the words; and I think that circumstance determined me to accept the invitation: I felt interested in a man who seemed more exaggeratedly reserved than myself.

Chapter I of Jane Eyre

There was no possibility of taking a walk that day. We had been wandering, indeed, in the leafless shrubbery an hour in the morning; but since dinner (Mrs. Reed, when there was no company, dined early) the cold winter wind had brought with it clouds so sombre, and a rain so penetrating, that further out-door exercise was now out of the question.

I was glad of it; I never liked long walks, especially on chilly afternoons: dreadful to me was the coming home in the raw twilight, with nipped fingers and toes, and a heart saddened by the chidings of Bessie, the nurse, and humbled by the consciousness of my physical inferiority to Eliza, John, and Georgiana Reed.

The said Eliza, John, and Georgiana were now clustered round their mama in the drawing-room: she lay reclined on a sofa by the fireside, and with her darlings about her (for the time neither quarrelling nor crying) looked perfectly happy. Me, she had dispensed from joining the group; saying, "She regretted to be under the necessity of keeping me at a distance; but that until she heard from Bessie, and could discover by her own observation, that I was endeavouring in good earnest to acquire a more sociable and childlike disposition, a more attractive and sprightly manner -something lighter, franker, more natural, as it were - she really must exclude me from privileges intended only for contented, happy, little children".

"What does Bessie say I have done?" I asked.

"Jane, I don't like cavillers or questioners; besides, there is something truly forbidding in a child taking up her elders in that manner. Be seated somewhere, and until you can speak pleasantly, remain silent."

A breakfast-room adjoined the drawing-room, I slipped in there. It contained a bookcase: I soon possessed myself of a volume, taking care that it should be one stored with pictures: I mounted into the window-seat: gathering up my feet, I sat cross-legged, like a Turk; and, having drawn the red moreen curtain nearly close, I was enshrined in double retirement.

Fold of scarlet drapery shut in my view to the right hand; to the left were the clear panes of glass, protecting, but not separating me from the drear November day. At intervals, while turning over the leaves of my book, I studied the aspect of that winter afternoon. Afar, it offered a pale blank of mist and cloud; near a scene of wet lawn and storm-beat shrub, with ceaseless rain sweeping away wildly before a long and lamentable blast.

References

- Arnold, D. et al., editors (1993). "Special issue on Evaluation of MT Systems", *Machine translation* 8 (1-2).
- Arnold, D. et al. (1994). *Machine translation: an introductory guide*. Manchester/Oxford: NCC/Blackwell.
- Baker, M. (2011). *In Other Words. A Course on Translation*. Routledge. New York.
- Beatty, K. (2010). *Teaching and Researching Computer-Assisted Language Learning*. London & Edinburgh. Pearson Education Limited.
- Beaud, Jean-Pierre (2014). Capítulo 9: La Statistique et la Politique. Centre Interuniversitaire de Recherche sur la Science et la Technologie. Université du Québec à Montreal. *Historia de la Probabilidad y la Estadística (VII)*. Asociación de Historia de la Estadística y la Probabilidad de España (A.H.E.P.E.).
- Brehm Cripps, J. (2007). *Targetting the Source Text: A Coursebook in English for Translator Trainees*. Universidad Jaume I.
- Crystal, D. (2011). *The Cambridge Encyclopedia of Language*. Cambridge University Press.
- Chitra, F. & Flavell (1981). *On Idiom, Critical Views and Perspectives* (Exeter Linguistic Studies 5). University of Exeter.
- Fortanet, I. (2002). *Cómo escribir un artículo de investigación en inglés*. Madrid. Alianza Editorial.
- Hovy, E. H. (1999). "Toward finely differentiated evaluation metrics for machine translation", in *Proceedings of the Eagles Workshop on Standards and Evaluation*. Pisa. Italy.
- Hurtado Albir, A. (2001). *Traducción y Traductología*. Madrid. Ediciones Cátedra.
- Hutchins, W. J. and Somers, H. L. (1992). *An introduction to machine translation*. London: Academic Press.
- Jordan, G., and del Castillo, B. (2012). *Translation Studies*. McGraw-Hill/ Interamericana de España, S.A.
- Lehrberger, J. and Bourbeau, L. (1988). *Machine translation: linguistic characteristics of MT systems and general methodology of evaluation*. Amsterdam / Philadelphia, John Benjamins.
- McCarthy, M., and O'Dell, F. (2005). *English Vocabulary in Use*. Cambridge University Press.
- Munday, J. (2012). *Introducing Translation Studies. Theories and Applications*. Routledge. London & New York.
- Papinei, K., Roukos, S. and Zhu, W. (2002). "A Method for Automatic Evaluation of Machine Translation". *Proceedings of the 40th Annual Meeting of the Association for Computational Linguistics (ACL)*, Philadelphia.
- Richards, J. C., Platt, J. and Platt, H. (1993). *Longman Dictionary of Language Teaching & Applied Linguistics & Applied Linguistics*. Longman Group. U.K. Limited.
- Robinson, D. (1997). *Becoming a translator: an accelerated course*. USA. Routledge.
- Ross, Sheldon M. (2010). *Introductory Statistics*. Third Edition. University of Southern California. Library of Congress Cataloging-in-Publication Data. Elsevier Inc. Book Aid International. Sabre Foundation.
- White, J. S. and O'Connell, T. (1994). "The ARPA MT evaluation methodologies: evolution, lessons and future approaches", in *Proceedings of the First Conference of the Association for Machine Translation in the Americas*. Columbia. Maryland.
- www.guardian.co.uk/
- www.gutenberg.org



Cuadernos de Trabajo

Facultad de Estudios Estadísticos

- CT05/2014** **Las medidas estadísticas: ejercicios motivadores**
Almudena Pajares García y Venancio Tomeo Perucha
- CT04/2014** **Jugando con la estadística (y la probabilidad)**
Gloria Cabrera Gómez
- CT03/2014** **Análisis Estadístico de las Consultas a la Base de Datos de Ayudas e Incentivos a Empresas de la Dirección General de Industria y de la PYME.**
Adolfo Coello de Portugal Muñoz, Juana María Alonso Revenga
- CT02/2014** **Values of games with weighted graphs**
E. González-Arangüena, C. Manuel, M. del Pozo
- CT01/2014** **Estimación de la tasa de retorno de la carta del censo de los Estados Unidos a través del modelo de regresión lineal y técnicas de predicción inteligentes.**
José Luis Jiménez-Moro y Javier Portela García Miguel
- CT03/2013** **Provisión de siniestros de incapacidad temporal utilizando análisis de supervivencia.**
Ana Crespo Palacios y Magdalena Ferrán Aranaz
- CT02/2013** **Consumer need for touch and Multichannel Purchasing Behaviour.**
R. Manzano, M. Ferrán y D. Gavilán
- CT01/2013** **Un método gráfico de comparación de series históricas en el mercado bursátil.**
Magdalena Ferrán Aranaz
- CT03/2012** **Calculando la matriz de covarianzas con la estructura de una red Bayesiana Gaussiana**
Miguel A. Gómez-Villegas y Rosario Susi
- CT02/2012** **What's new and useful about chaos in economic science.**
Andrés Fernández Díaz, Lorenzo Escot and Pilar Grau-Carles
- CT01/2012** **A social capital index**
Enrique González-Arangüena, Anna Khmelnitskaya, Conrado Manuel, Mónica del Pozo
- CT04/2011** **La metodología del haz de rectas para la comparación de series temporales.**
Magdalena Ferrán Aranaz
- CT03/2011** **Game Theory and Centrality in Directed Social Networks**
Mónica del Pozo, Conrado Manuel, Enrique González-Arangüena y Guillermo Owen.
- CT02/2011** **Sondeo de intención de voto en las elecciones a Rector de la Universidad Complutense de Madrid 2011**
L.Escot, E. Ortega Castelló y L. Fernández Franco (coords)
- CT01/2011** **Juegos y Experimentos Didácticos de Estadística y Probabilidad**
G. Cabrera Gómez y M^a.J. Pons Bordería

- CT04/2010 Medio siglo de estadísticas en el sector de la construcción residencial**
M. Ferrán Aranz
- CT03/2010 Sensitivity to hyperprior parameters in Gaussian Bayesian networks.**
M.A. Gómez-Villegas, P. Main, H. Navarro y R. Susi
- CT02/2010 Las políticas de conciliación de la vida familiar y laboral desde la perspectiva del empleador. Problemas y ventajas para la empresa.**
R. Albert, L. Escot, J.A. Fernández Cornejo y M.T. Palomo
- CT01/2010 Propiedades exóticas de los determinantes**
Venancio Tomeo Perucha
- CT05/2009 La predisposición de las estudiantes universitarias de la Comunidad de Madrid a auto-limitarse profesionalmente en el futuro por razones de conciliación**
R. Albert, L. Escot y J.A. Fernández Cornejo
- CT04/2009 A Probabilistic Position Value**
A. Ghintran, E. González-Arangüena y C. Manuel
- CT03/2009 Didáctica de la Estadística y la Probabilidad en Secundaria: Experimentos motivadores**
A. Pajares García y V. Tomeo Perucha
- CT02/2009 La disposición entre los hombres españoles a tomarse el permiso por nacimiento. ¿Influyen en ello las estrategias de conciliación de las empresas?**
L. Escot, J.A. Fernández-Cornejo, C. Lafuente y C. Poza
- CT01/2009 Perturbing the structure in Gaussian Bayesian networks**
R. Susi, H. Navarro, P. Main y M.A. Gómez-Villegas
- CT09/2008 Un experimento de campo para analizar la discriminación contra la mujer en los procesos de selección de personal**
L. Escot, J.A. Fernández Cornejo, R. Albert y M.O. Samamed
- CT08/2008 Laboratorio de Programación. Manual de Mooshak para el alumno**
D. I. de Basilio y Vildósola, M. González Cuñado y C. Pareja Flores
- CT07/2008 Factores de protección y riesgo de infidelidad en la banca comercial**
J. M^a Santiago Merino
- CT06/2008 Multinationals and foreign direct investment: Main theoretical strands and empirical effects**
María C. Latorre
- CT05/2008 On the Asymptotic Distribution of Cook's distance in Logistic Regression Models**
Nirian Martín y and Leandro Pardo
- CT04/2008 La innovación tecnológica desde el marco del capital intelectual**
Miriam Delgado Verde, José Emilio Navas López, Gregorio Martín de Castro y Pedro López Sáez
- CT03/2008 Análisis del comportamiento de los indecisos en procesos electorales: propuesta de investigación funcional predictivo-normativa**
J. M^a Santiago Merino
- CT02/2008 Inaccurate parameters in Gaussian Bayesian networks**
Miguel A. Gómez-Villegas, Paloma Main and Rosario Susi

CT01/2008

A Value for Directed Communication Situations.

E. González-Arangüena, C. Manuel, D. Gómez, R. van den Brink



UNIVERSIDAD COMPLUTENSE
MADRID