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# *Neural Machine Translation and Artificial Intelligence: What Is Left for the Human Translator?*

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## **ABSTRACT**

This dissertation aims to shed light on the impact of artificial intelligence and machine learning on translators. The current hype surrounding the recent progress in the field of artificial intelligence in this era of technology disruption has been welcomed very negatively by many translators, who feel their profession and position in society threatened by machines. Nevertheless, the figures demonstrate that this fear is unnecessary, since the number of job losses due to automation will be more than counterbalanced by the new ones where new skills will be required. The goal of the present work is assessing the progress of technology in the field of machine translation (MT) by comparing the performance of different MT tools, namely Systran, SDL Trados, DeepL, Google Translate and Amazon Translate, in the translation of snippets of text extracted from an e-commerce website. By illustrating with practical examples the improvements of neural machine translation – which bases its strength on machine learning – it is observed that the human factor will always be vital in translation, despite the high-quality output of neural MT tools. It is discussed that translators should rely on technology as a help in their job, since it allows them to be faster and, thus, more productive. Moreover, one the major advantages brought by neural translation is that it gives room to more involving and less frustrating tasks, increasing the translators' value for the activities where the human brain can excel. In this light, technology should not be feared, but rather considered as a benefit and a support to humankind. After all, humanity has been facing technological changes since the dawn of time, and it has evolved thanks to technology. Perhaps, the key lies in adopting a different perspective, embracing change and developing new skills. The new competences that will be asked from translators to thrive in the AI era will not only regard operative, managerial, technical or digital knowledge, but also empathy, emotional intelligence and creativity, i.e., those skills which belong to all human beings and will always differentiate them from machines.



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## INTRODUCTION

Today there are more than 7000 languages spoken across the world, implying that there is an incalculable number of translation requirements every second of every day. Translation, however, is not an easy task, since a language is not just a collection of words and rules of grammar and syntax, but rather a vast inter-connecting system of cultural references and connotations. In a more and more globalized world, where technology plays a fundamental role, it is not possible to think about languages as a barrier in the “Babel Tower” sense anymore. This change of perspective has been made possible thanks to machine translation tools, which have allowed people to break down the barriers between languages. In the 1990s, English used for communicating as a technological *lingua franca* allowed machine translation (MT) to gain a greater role, due to the need for fast processing and the tolerance of less than impeccable language forms, along with the levelling of culture-specific differences (Snell-Hornby, 2006: 133).

As will be described, the idea of machine translation is not a recent invention but it rather dates back to the 17th century. In 1629, René Descartes proposed a universal language, with equivalent ideas in different tongues sharing one symbol:

Therein lies the challenge in machine translation: how to program a computer that will ‘understand’ a text as a person does, and that will ‘create’ a new text in the target language that sounds as if it has been written by a person.

Immediately after the Second World War, in order to meet the increasing demand of translation to overcome the linguistic barriers among countries, scientists were starting to acknowledge the importance of mechanical translation: at the Eighth Annual Roundtable Meeting on Linguistics and Language Studies in 1957, a number of scholars questioned the possibility of achieving fully automatic machine translation of high quality. As observed during the “Translating Europe” forum held by the European Commission on 8-9 November 2018, the history of MT is one of great disappointments: in the 1960s scientists realized that the process of automating translation would not have been so straightforward as it seemed. Then, at the beginning of the 2000s, translators started worrying about losing their jobs due to the improvements in the field of automated translation. Nowadays, there is great hype in Neural MT (NMT), whose output seems almost indistinguishable from human translation (Google AI Blog 2016) and research

predicts that NMT will play an ever-increasing role in enterprises' multilingual content strategies (CSA Research 2018). As a consequence, translators fear that their job will disappear because of computers.

The information economy emerged at the end of the twentieth century because the technology revolution provided the tools or the material basis for this new economy. As Cronin (2003) observes, the era defined as "Post-Fordism" characterized by the gig economy, features new paradigms such as lean production, flexible work schedules, the horizontal corporation, the meteoric rise of subcontracting and the exponential increase in advertising budgets. Nevertheless, the impact of AI is the real shift challenging these years of technological disruption. The new AI paradigm is so pervasive that weekly summits and conferences throughout the world focus on discussing its impact on our everyday lives. It now powers a wide variety of real-world applications, ranging from facial recognition to language translators, from home-assistants like *Alexa* or *Google Home* to self-driving cars. The adoption of technologies for automation and AI will profoundly transform the work environment in the next 10-15 years and people will find themselves interacting with increasingly sophisticated machines. AI's impact on work will be profound, to the extent that it will drive the future world GDP growth. Recent research (McKinsey 2018) shows that there will be numerous economic and social benefits, as 60% of the estimated productivity growth for the next decade will be generated by the digital. Some occupations as well as demand for some skills will inevitably decline, while others are bound to grow and, most of all, change as people will work alongside ever-evolving and increasingly capable machines. In this scenario, new technologies will help to create new jobs by compensating for those that will be automated, as it has already happened in the past with other technological revolutions. The difference with today's changes is the extent of their scale and speed. A profession which cannot be exempt from the profound alterations brought about by these changes is that of translation: in an era where the main resources driving the new economy are information and knowledge, it has inevitably been affected by the fundamental changes in the way in which the world does business. Indeed, the persistent improvements in AI and machine learning applied to MT have led to a perceived threat to the professionalization of web localization to the extent that claim such as that of the futurologist and cybernetic Kurzweil, who in a 2011 interview predicted that from 2029

machine translation will be able to replace humans, seem to be an upcoming reality (Galati and Riediger 2017).

However, research shows that the growth in demand for work with new digital skills needed to keep up with rapidly evolving and increasingly capable machines will more than counterbalance the number of jobs lost to automation, as the number of jobs gained through them could range from 555 million to 890 million, or 21 to 33 percent of the global workforce (McKinsey, 2018). According to a Common Sense Advisory (CSA) report on the language services market, the global market for outsourced language services and technology reached \$46.52 billion in 2018 (CSA 2018). This means that the language industry is a great business, therefore translators will never be unemployed. Nevertheless, the improvements in AI and machine learning holds the promise of delivering a significantly better output than what has been produced so far, implying that the role of the translator will have to adapt to new changes.

The time of fragility, temporariness, vulnerability and inclination to constant change as the one in which we are living – defined by Bauman as “liquid modernity” – implies that if we want to survive we must be able to adapt to change. As Bauman observed, if “a hundred years ago ‘to be modern’ meant to chase ‘the final state of perfection’ – now it means an infinity of improvement, with no ‘final state’ in sight and none desired” (Bauman, 2000: 7). In this respect, we understand that continuous transformations and innovations certainly imply that translators must be intrinsically alert, as they must be perpetually on the move. (Cronin, 2003: 105). That is to say that translators are not exempt from the changes of this fluid modernity, therefore they have to find new ways to develop their skills in the technosphere (Cronin, 2003: 29) in which they are engaged. An innovative view of translation was expressed by Scattergood, Localisation Technology Group Manager for Symantec, whose best-known product is the Norton AntiVirus software:

I’m looking for edges all the time. If our engineer does something twice, I want to know why, and how our tools can remove the repetition. Speed, automation, and elimination of the slowdown factor of repetition are repeated concerns for the cost-conscious localization sector. (Cronin, 2003:18)

This claim expresses one of the main points which this dissertation aims to shed light on, i.e., that constant improvement of machines in order to allow humans to reduce repetitive tasks is affecting more jobs, including that of translators. However, the inevitable changes

brought in the workflow by AI suggest that the threat perceived by translators, who feel undermined by machines, might be changed into a new perspective.

The aim of this thesis is to suggest that the claims which have been repeated in the mainstream tech press, promising world-changing results, should not lead translators to perceive technology as a threat, but rather to accept MT as aiding tools. Their contribution will therefore increase the translators' value for the tasks where the human brain can excel, making them "visible not at the dusk of an old century but at the dawn of a new one" (Cronin, 2003: 44). Researchers agree that by automating routine or unsafe activities as well as those prone to human error, AI could allow humans to be more productive and to work and live more safely. Furthermore, automation will spur growth in the need for higher cognitive skills, particularly critical thinking, creativity, and complex information processing (McKinsey 2018). For this reason, by diverting the translators' attention from repetitive tasks, automated translation will finally allow them to focus on developing the extraordinary traits of our species, educating ourselves in the broader sense of the term, developing creativity, and so forth.

In order to suggest the importance of the human component in the translation process, I will describe and compare different MT tools used to translate the e-commerce website of the jewelry company I have been working at for three years, namely Alfio Lago Jewellery. This project derived from the company's need to open its business to internationalization due to the growing competition, by exploiting the digital resources at hand. This work will expand upon the process of localization with a major focus on the aid of MT and the role technology is playing with regard to the translation job, focusing on the post-editing process and the new skills which are required from translators in the present AI era. Together with the technical translation part, the present work is motivated by trying to answer the question of what is the role of the human translator in the translation process, at a time when machines and AI seem to be taking over and covering all fields of work. Indeed, the advent of the Internet has brought new tools for the solution of problems, but has also given rise to new issues for translators, which see their profession threatened by MT. Along the lines of experimental research methods described in Chapter 3 and 4, I shall try to assess the cognitive process involved in the translation by means of think-aloud protocols, in particular during the post-editing task, demonstrating that the human factor is – and will always be – vital in a process which

involves the transformation of language, one of the main characteristics that distinguishes human beings from the other species.

The work is structured as follows: Chapter 1 provides an overview of the e-commerce world scenario, the current digital trends and the impact of digitalization on our everyday life. The data provided were kindly granted by Euromonitor International, a worldwide provider of strategic market research which creates data and analysis on thousands of products and services around the world. E-commerce websites are defined by Jiménez-Crespo as a complex-genre (Jiménez-Crespo, 2013:29) as they incorporate other genres in their structure, such as a sign-up form, marketing material, a purchase contract and so forth. Therefore, the localization process needs advanced planning and the client should be sensitive to the target users, their needs and the reason why they should use the translated content. These issues shall also be dealt with in Chapter 4, which expounds upon the editing work for which the post-editor is responsible.

Then, the concept of localization is described with reference to the GILT process, the acronym for Globalization, Internalization, Localization and Translation (Jiménez-Crespo, 2013: 23), whose interrelated stages reflect the complexity of the localization process. Today's consumers are more than acquainted with the concept of shopping online, since the use of personal computers has been sided and overcome by the popularization of smartphones. New digital tools have allowed consumers to commerce anytime and anywhere, and their developments will continue to reinvent commerce in the years to come. For this reason, anyone owning an e-commerce website should be ready to exploit the chances offered by digitalization and internationalize their website to reach a wider audience. Consequently, the demand for translation will increase in the years to come. At the same time, the profound changes brought by AI which are slowly but increasingly impacting society are causing major changes in the job of the translators, who feel threatened in their position in society (Mossop 2017). Before the advent of the Internet, the profession of the translator was largely practiced by individuals, whereas now the increasing need of multilingual content due to the presence of the digital has transformed it into a formally recognized industrial sector which is project-based, heavily outsourced and includes a wide range of services in addition to translation.

Nevertheless, the advent of multimedia communications and the new necessity for business internationalization require e-commerce websites translators to possess not only

language mediation skills but also “heightened cultural expertise” (Snell-Hornby, 2006: 133). Moreover, digital users are offered a wide range of information supply along with the possibility of consulting many websites at the same time. In such a scenario, where users are loaded with a huge amount of data to process, translators are required to know their target readers and their habits and expectations, along with website conventions, whose aim is to “establish a coordination equilibrium between participants in recurrent communicative situations” (Jiménez-Crespo, 2013: 83). For this reason, Hofstede’s dimensions of perception, symbolism and behaviour are outlined in order to shed light on the cultural aspects to be taken into consideration in web localization as well as translation in general.

Chapter 2 focuses on the history of MT, dating back to the late 1950s and describing the improvements of automated translation up to the current updates in the present state-of-the-art neural translation. As will be shown in the overview of the history of MT, despite periods of significant scientific advances in the six decades since, AI has often failed to be as good as what was expected from it. Nevertheless, after periods of hype followed by several “AI winters” over the past sixty years, today we are witnessing a paradigm shift. Machine learning algorithms have progressed, especially through the development of deep learning and reinforcement-learning techniques based on neural networks (McKinsey 2018).

Deep learning relates to a set of techniques to implement machine learning based on artificial neural networks, which loosely model the way neurons interact in the brain. For this reason, machine learning can require large amounts of human effort to label the training data necessary for supervised learning, hence one of the major changes in the translators’ job, which requires them to be able to handle data in order to become qualified ‘trainers’ of machines.

After a presentation of the history and advancements reached by MT technology, Chapter 3 describes the MT tools used for the project. Systran and SDL Trados are among the most used and cited language service providers in the market (CSA Research 2018). Along with them, I decided to compare the following state-of-the-art neural MT tools, namely DeepL, Google and Amazon Translate. By means of comparisons between snippets of texts taken from the website, the work shall demonstrate that NMT delivers a significantly better output than SMT, which can be extended to areas where current

solutions are not good enough and content remains untranslated. Along with features like Translation Memories (TM) and User Dictionaries, natural language processors are presented to show how AI and machine learning can be exploited by translators to save time and obtain a better translation output.

Chapter 4 presents the principles guiding the post-editing process – by which a human translator amends and improves a machine translation – mainly relating to Mossop’s guidelines which include structural editing, content editing, stylistic editing, copyediting and consistency check. The need for post-editing MT output relies on the fact that communication is extremely complex and context-related, and relying only on MT would mean ignoring such complexity. Translation between languages is not “just a matter of replacing the words” (EAMT 2018), but rather requires a careful consideration of several criteria. Therefore, human post-editing becomes vital to ensure that a machine-generated translation will achieve a publishable quality. By observing that its most frustrating part relates to the repetitive correction of the same trivial mistakes, some of which shall be listed in a taxonomy, it is pointed out that the changes brought by the use of AI will allow translators to deal with more challenging tasks. As research observes, if the mechanic tasks of the translators’ job are to be performed by machines, a lot of space will be left for human creativity (Fiederer and O’Brien 2009), (Jiménez-Crespo 2013), (Bentivogli 2016), (Agrawal 2018) (Senellart 2018). Indeed, neural machine translation will require translators to become trainers of the machines, selecting and providing “clean data” (Post 2018) to feed the systems. As will be shown in the training process of Google Auto ML Translation, the human involvement in the training phase is the very factor which allows machines to produce a satisfying output. Consequently, the translator is transformed into a sort of teacher who facilitates the process of machine learning.

Chapter 5 concludes the work by describing the skills that will be required from translators to keep up with a world which is evolving at a more and more rapid pace, where the demand for translated content is increasing due to the unifying power of technology. Along with declarative and operative knowledge, a new range of competences will be required from translators in order to face the new changes brought by AI in such an ever-changing economic, political and social scenario. Indeed, technological, procedural and managerial skills will need to be sided with skills related to the emotional sphere, such as communication and empathy.

To sum up, the dissertation will show that NMT represents a significant improvement over state-of-the-art SMT, and it will inevitably transform how language professionals work. Nevertheless, the thesis seeks to demonstrate that AI will not replace human translators any time soon (CSA Research 2018). It will rather help them increase their productivity and focus on the “human parts” of their jobs, namely, those aspects that require their expertise and creativity.

## **CHAPTER 1: Ecommerce and Localization**

### **1.1 The worldwide e-commerce scenario and the need for internationalization**

Now more than ever, if they want to flourish, both leading and emerging business have to consider the idea of being international. Today's consumers are more than acquainted with the concept of shopping online as the use of personal computers has been overcome by the spread of smartphones. The new digital tools have allowed consumers to commerce anytime and anywhere and their development will continue to reinvent commerce in the years to come. Thus, the massive growth of digital technologies and their spread has inevitably led more and more consumers to shift to digital platforms, meaning that companies have a lot of new resources available to reach potential customers all over the world. Hence, they must rethink their strategies to compete in a digital world.

E-commerce is the only industry that is experiencing double-digit growth, and forecasts indicate that it will continue to grow in this direction: the total retail e-commerce is predicted to grow by 20% (combined annual growth rate) to become a \$4 trillion market by 2020 (Nielsen 2017). From the birth of the Network and e-commerce to date, the evolution has been rapid and, thanks to new technologies and the spread of artificial intelligence and the Internet of Things, the growth that we will see in the next decade will be increasingly rapid and significant. In 2017, 1.79 billion people in the world carried out an online purchase (eMarketer 2018).

According to a Euromonitor International research published on 22 October 2018, the current scenario sees Australia, South Korea, United Kingdom, Denmark, USA as the top five countries with the highest number of digital consumers, whereas Italy ranks in 26th position. The chart below displays the ranking of the Digital Consumer Index, developed to assist companies with identifying which geographic markets are the most digitally attractive and offer the best prospects for future deployment of digital commerce. Australia results as highest digital ranking as it is a global trendsetter in terms of fast adoption of mobile technologies.

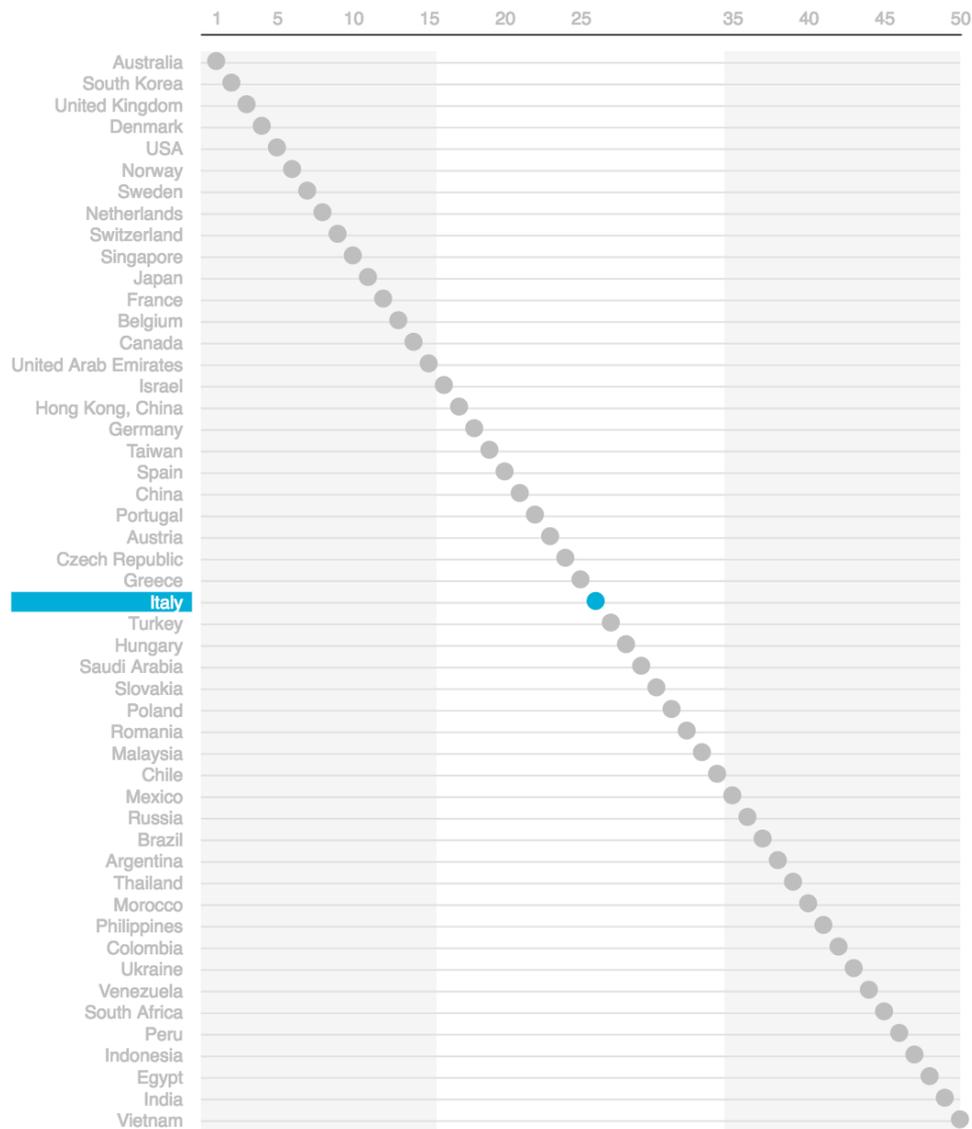


Figure 1: Digital Consumer Index, Countries sorted by rank. (Euromonitor International, 22/10/2018)

In this context, the presence of businesses on the web is currently a prerequisite for competing in a globalized market. This massive shift in consumer habits from the perspective of manufacturers and retailers to online platforms requires Italian companies to be able to intercept current trends and cope with them. The value of e-commerce in Europe is estimated at 602 billion euros in 2017, 14% more than in 2016. Today, indeed, 68% of European internet users shop online.

The leader in terms of turnover is the United Kingdom: Brexit has influenced the contraction of domestic consumption and the increase in exports due to the subsequent rapid devaluation of the pound, but the online sales of the country continue to grow and

in 2017 are estimated to have reached the level of 197 billion euros in B2C e-commerce sales, 20% more than the previous year. The second largest B2C e-commerce market in Europe is Germany.

These data shed light on the fact that nowadays it is particularly important for companies that do not have a physical presence in other countries or cannot benefit from belonging to multinational groups, to have a website translated into more languages. The percentage of foreign turnover in total online sales is 32% for companies with a multilingual site, whereas it drops to 19% for companies selling in other countries through a website in Italian.

Foreign markets are certainly full of opportunities, however it must be borne in mind that in a digital world where there is so much competition, consumers are now increasingly demanding, prepared and, above all, very selective. Therefore, it is necessary to be aware of which countries to focus on.

When the Alfio Lago Gioielli owners decided to expand and open an e-commerce website, the strategy included an internationalization plan, with a long-term vision. For this reason, the choice of product to be sold on the website was influenced by internationalization. Therefore, specific international jewellery brands were chosen as they would be appealing for foreign markets too. The Euromonitor International platform allows consumers to see market prospects for countries as well as shopping categories, such as apparel and footwear, beauty and personal care, food and drinks, online travel agencies, pet care and so forth.

The products sold by Alfio Lago Gioielli, namely jewellery and watches, are comprised in the category labeled “Personal Accessories and Eyewear”, which, as shown in the figures below, sees USA, China, Japan, United Kingdom and Germany as leading markets. Interestingly enough, Colombia, Saudi Arabia, Romania, Greece and Israel are ranked among the fastest growing countries, whereas the greatest growth until 2021 is expected to be experienced by leading USA and China, but also by emerging countries like Colombia and Japan. Therefore, the global digital landscape will be defined by the narrowing if the digital gap between developed and emerging markets (Euromonitor International, Digital Commerce Opportunities, 2018).

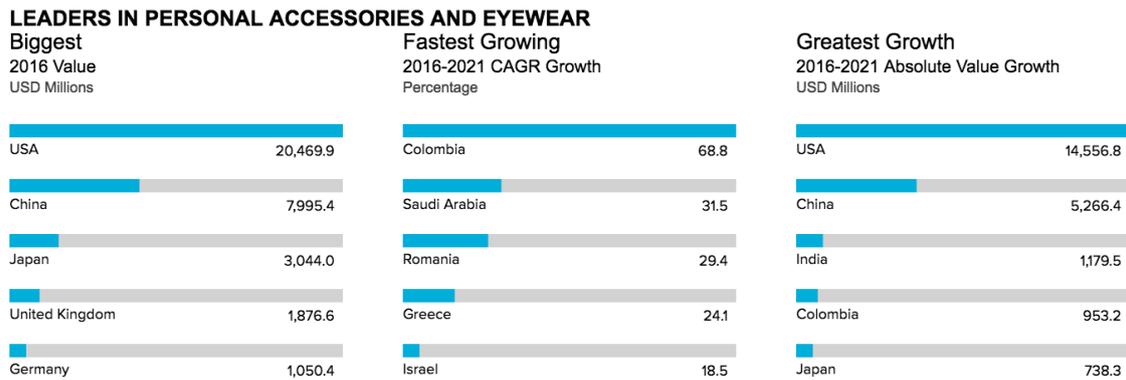


Figure 2: World leading countries in personal accessories and eyewear. (Euromonitor International, 22/10/2018)

Google Market Finder is a useful tool that companies can exploit to get market suggestions for implementing an international marketing strategy. This tool can be used to have an insight into the best markets for a company product or service, and be provided with suggestions on how to prepare for new markets and how to implement the right digital marketing solutions.

After providing the url of the website [www.alfiolago.com](http://www.alfiolago.com), Google Market Finder collects the five most important categories (in this case: Bracelets, Diamond Jewelry, Engagement Rings, Earrings, Watches & Watch Accessories) and provides insights into the top markets that best match those categories. The top ranked countries found by Google Market Finder for the categories selected are USA, UK, Germany, Japan, France, Australia and Canada. In addition to showing the suggested markets, the tool also provides information about the key insights into the target countries, such as the disposable income of potential customers and their internet behavior. The most useful information provided includes population size, currency, median age, economic information such as GDP and GDP per capita, purchase behaviour, logistics and, most importantly for my project, languages spoken, which are essential for localization requirements. According to the insights, English – as the worldwide *lingua franca* of science and business – is also the first or second language in all Alfio Lago Gioielli target markets (except from Japan, whose three main languages are Japanese, Central Okinawan, and Korean). Consequently, the internationalization of the e-commerce with an English translation is a necessity in order to compete and be relevant in the target markets.

In order to have an overview on the traffic on the website, the most frequently used tool is Google Analytics. This online platform allows people to understand the performance of the website as well as users' behaviour in order to better evaluate the performance of content, marketing and products of the website. After connecting the platform to the website, it is possible to get a complete view of customers' origin, preferences, behaviour, device and so forth. The data collected from the Google Analytics insights of the website [www.alfiolago.com](http://www.alfiolago.com) shed light on the fact that many customers access the website from all over Europe and the items sold are objects of interest to potential customers from all over the world.

Paese	Utenti	% Utenti
1.  Italy	75.591	93,60%
2.  United States	3.208	3,97%
3.  Germany	182	0,23%
4.  Switzerland	125	0,15%
5.  France	117	0,14%
6.  United Kingdom	116	0,14%
7.  Brazil	104	0,13%
8.  Spain	78	0,10%
9.  Peru	75	0,09%
10.  Romania	64	0,08%

*Figure 3: Insights on the users of the website [www.alfiolago.com](http://www.alfiolago.com) (September 2017 to November 2018). Source: Google Analytics*

The analytics data show that, as expected, the great majority of visitors (93.6%) comes from Italy. Nevertheless, almost 4% of visits come from the USA, which is a major number with relation to the total number of visitors, along with other European countries such as Germany, the United Kingdom, ranking 6th and Ireland, 11th. These figures are a clear indicator that there is a potential interested audience in those countries, which proves that it is important for companies to have an international mindset.

However, being international is something that cannot simply be decided on the spur of the moment, but rather requires careful planning in advance. Developing e-

commerce for foreign markets means implementing a series of technical and organizational solutions aimed to overcome the difficulties related to the physical distance that separates the company from customers, as well as being sensitive to cultural differences with different markets, differences in standards, tax issues, organizational and site operation. For each organization, the network requires a medium-long term strategy to define priorities, feasibility, implementation and evaluation of the ROI. A network strategy presupposes a vision of a whole in which business models, communication and web marketing are jointly evaluated.

## **1.2 The Localization Process**

Localization is a process that needs to be thought of from the very beginning and planned for at every stage of the product development. According to Jiménez-Crespo (2013: 12), different parties are involved in the localization process: not only professional translators, translation scholars and localizers, but also computational linguistics researchers, industry experts, management and business agents, developers and researchers from a myriad of disciplines such as international marketing, technical writing, usability and so forth. In this project, I tried to sum up and provide the common characteristics that feature in several definitions of localizations, which is defined according to various approaches such as functionalism, reductionism, pragmatism, cognitivism and socioculturalism.

In the still ongoing debate whether localization is another form of translation or a completely distinct phenomenon, Jiménez-Crespo (2013: 22) suggests that we should consider it an expansion of translation as a consequence of technological advances and business forces. As stated by LISA – Localization Industry Standards Association – “Localization involves taking a product and making it linguistically and culturally appropriate to the target locale (country/region and language) where it will be used and sold” (in Jiménez-Crespo, 2013: 13). This definition makes clear that the localization process incorporates both a linguistic and cultural component – which, according to the author, were consistently kept apart by the industry. According to GALA – a global, non-profit trade association for the translation and localization industry – “the goal is to provide a product with the look and feel of having been created for the target market to eliminate or minimize local sensitivities.” (in Jiménez-Crespo, 2013: 16)

Chapter 4 will show that when I had to translate snippets of texts from the e-commerce website dealing with Italian culture-bound aspects I had to make some changes as they were not suitable for a non-Italian markets.

From a translation perspective, adhering to the “look and feel” of locally made products means that the users are not supposed to perceive any of the potential ‘foreignness’ of the texts they interact with. Nevertheless, the GALA’s definition requires focusing on the particle ‘for’. The goal to provide a product created *for* the target market does not mean created *in* the target market. Namely, cultural adaptation does not mean “to mislead the used into believing that the website is a local production, but rather to perceive that the company is conscious and respectful of the receiving culture” (Jiménez-Crespo, 2013: 32)

According to LISA, localization “generally addresses significant, non-textual components of products or services in addition to strict translation”. Therefore, being “conscious and respectful” of a receiving culture means that language is understood to be only a part of the process, which includes visual and technical aspects, as well as cognitive aspects, such as navigation, metaphors, mental models or interaction.

Hence, rephrasing a definition from GALA in 2011, apart from the textual aspect, localizing includes also the adaptation of content layout to fit the translated text, the conversion to local currencies, the use of proper formats for dates, addresses and phone numbers, dealing with local regulations, but, most importantly, the consideration of cognitive and pragmatic aspects. Non-textual content includes colours, icons, packaging and so forth. If a website is culturally adapted, the navigation and the interaction environment are more efficient and clear for the user. This ensures a better impact of the website and, as a consequence, of its rating.

According to the marketing principles, in order to sell, an e-commerce website has to meet the inner desires of people, and understand which is the right note to strike in order to impress and be remembered from the target audience. To create a localized website means to localize most content and pages, keeping the original functionalities and back-end. Culturally adapted websites, instead, are the most advanced level of localization totally adapted to the target locale in relation to the levels of Hofstede’s cultural descriptions, which will be explained below.

However, due to cost and lack of resources, very few websites are localized to the highest level – an example cited in Jiménez Crespo is IKEA (Singh and Pereira, 2005). A good example of localization in the category of jewellery is represented by the Danish company Trollbeads, an international brand of fashion jewellery which creates charms for bracelets and necklaces. From the very first step in the navigation, the user is asked which country he/she is interested in:

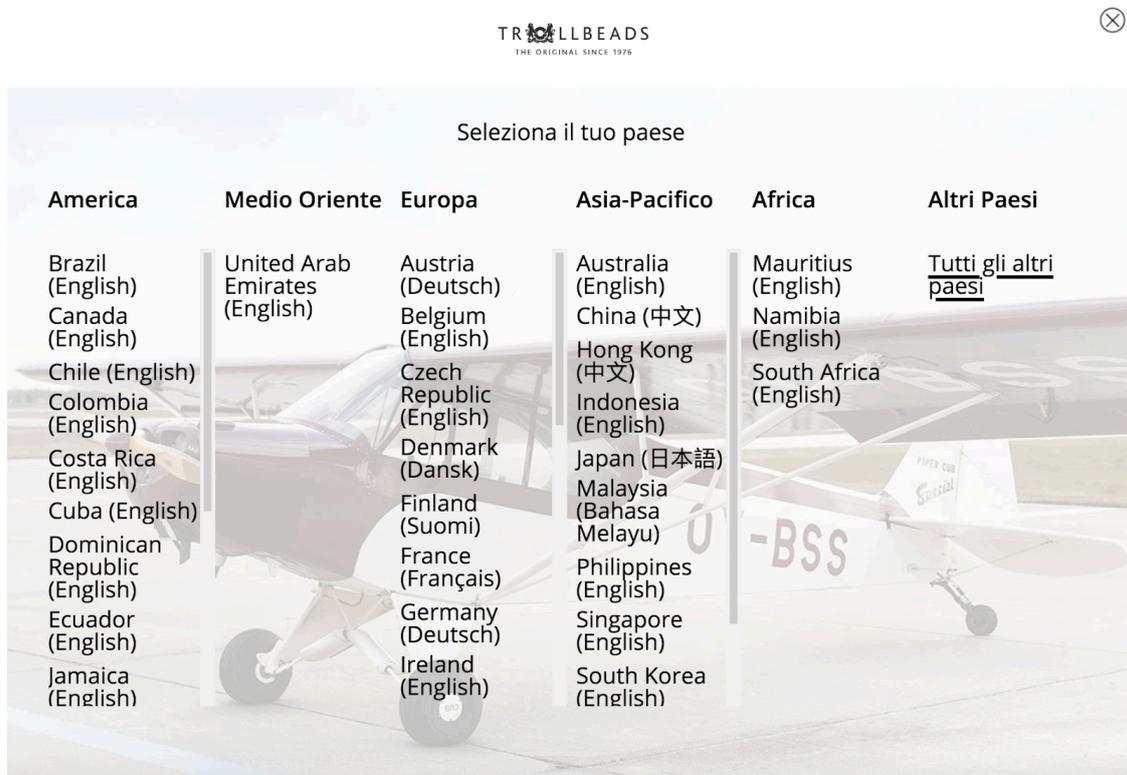


Figure 4: The country choice option in Trollbeads website

As will be shown in the screenshots below, when choosing the countries, the different homepages change according to the target culture, i.e. a customized homepage is created and targeted for its users. The German homepage, for instance, advertises the charm dedicated to the Grimm brothers' fairytale "Die Bremer Stadtmusikanten" – translated into English with "The Bremen town musicians", by displaying the image of the city of Bremen, which the fairytale is inspired by. The Italian homepage, instead, displays an image presenting the "Giro d'Italia", – the "Italian tour" – which is the name of a collection of charms dedicated to the peculiarities of each Italian region. While the majority of the charms are sold around the world, there are some which can be found only in some countries – as in the case of "The Bremen town musicians", or the beads from

the “Italian tour”. Therefore, as will be shown in Chapter 4, some product descriptions of Italian products will have to be edited according to an international perspective.

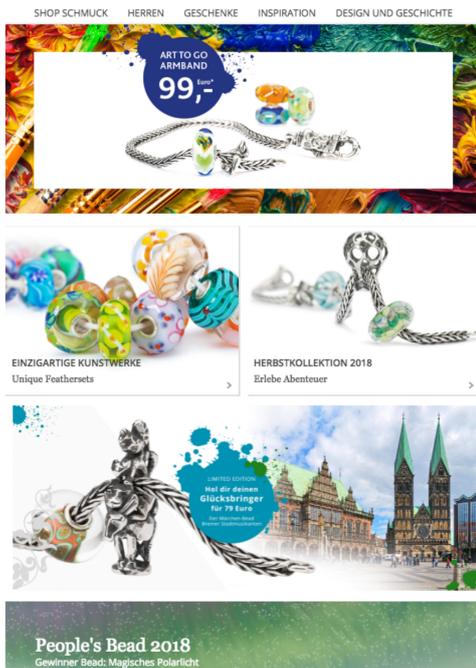


Figure 5: Trollbeads Germany Homepage

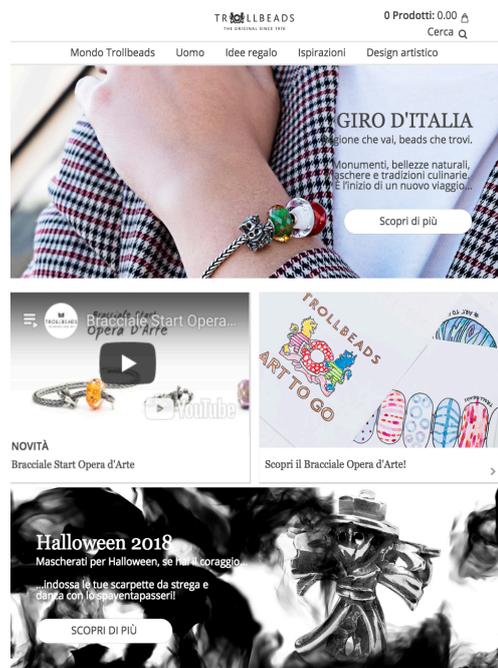


Figure 6: Trollbeads Italy Homepage

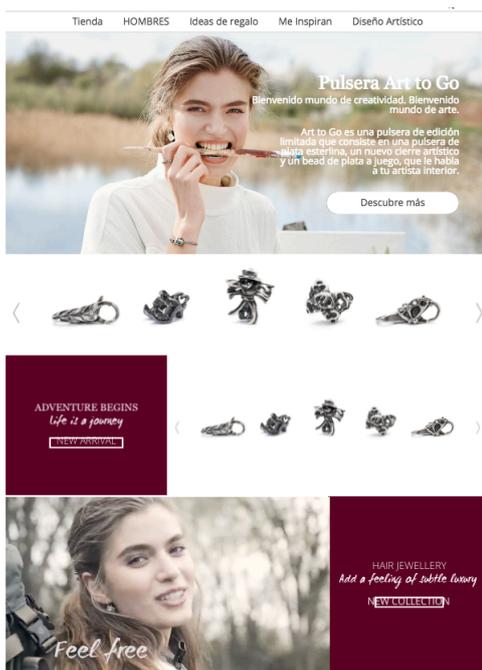


Figure 7: Trollbeads UK Homepage

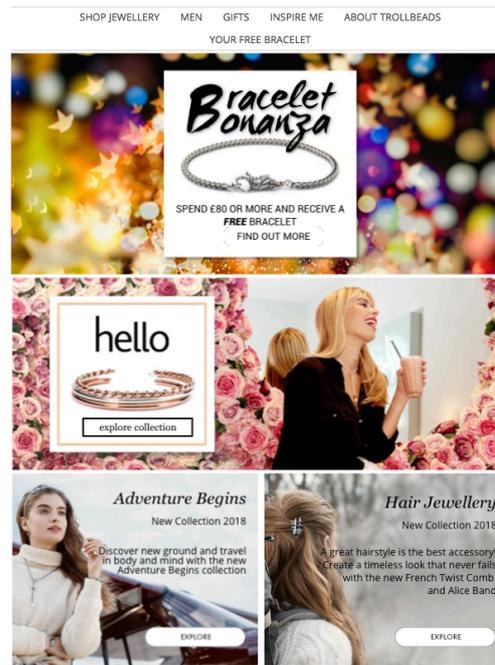


Figure 8: Trollbeads UK Homepage

The localization process does not only involve the appearance of the homepage, but also the content of the website. A peculiarity of this jewellery brand is that each charm is provided with a short story, whose captivating words are aimed at involving the users. For instance, the story related to the Christmas charm called “Coperta di Cuori” in Italian, reads: “Il calore del tuo amore riscalda il mio cuore”. However, in the UK website both the name and the caption are different, as the name of the bead is “More Cookie Joy Bead”, and its description “Yummy! It is finally time for some Christmas baking”. Interestingly, the same charm is called in German “Große Weihnachtsbäckerei” – meaning “Great Christmas bakery”– and its caption reads “In der Weihnachtsbäckerei, gibt's so manche Leckerei...”, – “In the Christmas bakery, there are so many delicious things...” – which is the opening sentence of a famous German Christmas song. The examples taken from the company Trollbeads show how important is to consider the target locale’s culture in addition to its language in order to become international.

Among the several perspectives that have studied the cultural aspects in web localization, the approach with the highest impact is, according to Jiménez-Crespo, the international marketing approach of Singh and Pereira, who adopted Hofstede’s dimensions of perception, symbolism and behaviour (Jiménez-Crespo, 2013: 32). According to scholars, there are specific measurable website features related to these dimensions. As the social psychologist explains, all countries in the world share the same basic questions to which each society has developed its own answers. Their research revealed six basic problems that all countries of the world share, which he defines as separate dimensions of national cultures. The first one relates to the inequality among people and it is labeled “power-distance” dimension, the second one poses the question how afraid we are about the unknown, which is referred to as “uncertainty avoidance”; the third, “individualism vs collectivism”, focuses on how much dependent we are upon other people. The fourth dimension questions if and how differently do men and women feel, which is called “masculinity vs femininity”; the fifth asks whether we are focused on the future, past or present and is labeled “long vs short-term orientation” and, finally, the sixth is a measure of happiness; related to whether or not simple joys are fulfilled, and is called “indulgence vs restraint”.

Hofstede’s model, which is applied in international communication, negotiations, international management as well as marketing, aims at giving insights into other cultures,

in order to facilitate cross-cultural communication, as dealing with other culture requires being aware of cultural differences. As Hofstede points out: “[...] we should develop skills for translating between cultures. When in another culture, in a way, we become children again” (Hofstede 2015).

The dimension called “uncertainty avoidance” applied to ecommerce strategies, for instance, is particularly important for planning the layout of a website, as a user-oriented e-commerce will take into consideration the importance of predictability, structure and order which is essential in order not to mislead the user during navigation. Users of websites have a lower tolerance of uncertainty, since they are endowed with a mental model as a result of their experiences on other sites. This mental baggage inevitably generates expectations which influence their cognitive processing of texts. Thus, providing them with conventional and familiar features will reduce their cognitive effort in the processing of information. The sense of control users have in a predictable designed website – which is a hard-wired cognitive requirement in the brain – increases their satisfaction about their experience. For a website not to lose its credibility, it is essential that it does not lack familiar features expected by the target audience. Predictability, thus, creates a sense of comfort which keeps people on the site and engaged. Conventions play a vital role on web interfaces, where users are presented with a large number of simultaneous choices.

As for the individualism–collectivism dimension, US and Australia rank very high, thus good privacy policies or personalization will be more effective. On the contrary, Latin or Indonesian countries which rank very low will appreciate chats, or community related features (Jiménez-Crespo, 2013: 33). Advertising, whose effectiveness relies on its cultural accuracy, will therefore be different from culture to culture, as will be special marketing promotions related to specific festivities. The two images below represent two commercial calendars, which compare the different marketing schedules in Italy and USA.



Figure 9: Italian Commercial Calendar. Source: Prestashop



Figure 10: USA Commercial Calendar. Source: Prestashop

As can be observed, the two countries present many differences in terms of festivities. Among those recognized and celebrated all over the world, such as Christmas or New Year's Eve, the US calendar displays many festivities which are only related to the US history and culture such as Thanksgiving, Columbus Day, the Independence Day or national events like the Super Bowl. Furthermore, there are festivities which are shared among countries, such as Father's Day, which nevertheless are celebrated on two different days: while Father's day is celebrated on 19<sup>th</sup> March in Italy, in the US it is celebrated on the 17<sup>th</sup> June. Finally, there are festivities which are merely commercial and related to countries like US or China – where e-commerce and technological improvements have a longer history than in Italy. Boxing Day originated in the UK and takes its name from the habit of the aristocracy to give presents to servants and of tradesmen to collect “Christmas boxes” of money or presents on the first weekday after Christmas as thanks for good service throughout the year. Therefore, most retailers launch online sales on these occasions, which, according to the trends, are usually extended until New Year's Eve. This is important as any business wanting to open a new market in the US should get accustomed and sensible to such information in order create marketing campaigns and content suited to US users.

As localization is placed within the wider paradigm of market globalization, it requires companies entering foreign markets to prepare for it from the early stages of product development. Such complex of interrelated processes is known as GILT, acronym for Globalization, Internalization, Localization and Translation (Jiménez-Crespo, 2013: 23), and it is essential to study in order to be ready to enter a foreign market.

Globalization is primarily concerned with the customer support around the world. Thus, it entails enterprise decisions from personnel to marketing to be adapted globally. Having to cope with a multiplicity of bilateral or multilingual interactions, it is a cyclical process, not confined to the first stages of the process.

On the other hand, internalization regards the development stages of the digital product, and it is concerned with the technical preparation of a product for localization. According to a definition given by LISA, one of the goals of internalization is to avoid having “language-specific features” that will be an obstacle when the product is localized (Jiménez-Crespo, 2013:25). The actual localization process is the third step in the cycle, and it refers to several tasks related to the preparation, management, engineering and

quality assessment of the products. As for translation, the final stage in the process, it is understood as the actual transfer of textual material and it is often outsourced and considered as a separate stage within the industry. Indeed, freelance translators are normally given up to 80% of the volume of texts (Jiménez-Crespo, 2013: 26).

For these reasons, many digital platforms have been created, whose purpose is to deliver relevant information and high-quality content. Leading content creation and translation platforms such as Melascrivi, Textbroker, Greatcontent, offer professional translation services with both mother tongue and bilingual translators. These platforms allow companies to outsource the production of digital content, as well as translations. The authors can apply to the platform with an application form and, after having described their experience and provided unique sample texts, their work is evaluated by the platform's QA team, which will make a decision according to objective qualitative criteria. Once the authors' application has been approved, they can choose among the available request, and start translating. On its part, the client requiring the content or translation needs to register in the platform, upload the files to be translated, indicate the delivery date for the translation when placing the order and, most importantly, providing a brief with requests, as a guide to the translator. These platforms provide a self-service option where the client can determine the quality level of the content as well as its cost. To ensure the highest levels of quality, the QA team of editors regularly rates every author for quality. Platforms like the ones mentioned above are becoming widely used among e-commerce websites to translate their content, as the presence of human translators serves as incentive in terms quality output. Nevertheless, human translation from scratch is expensive and requires a great amount of time, therefore the use of machine translation (MT) tools has become unavoidable for translators, who manifest contrasting feelings towards them, mostly considering what should be an aid as a threat to their job instead. This issue is the core question of this dissertation and will be expounded upon in the following chapters.

The already discussed complexity of the localization process usually requires the intervention of many agents with different skills. In his book, Jiménez-Crespo provides a subdivision of the several tasks involved in the web localization process.

The initial project preparation and acceptance, usually performed by localization managers and engineers, involves many steps such as the definition of the localization

scope with the clients, the analysis of the website, architecture and content, the definition of the future architecture of the localized website, the setup of all the components to be sent to translators and so forth. The part where localization specialists or freelance translators are the protagonists and which is the bulk of the localization process comprises the creation of a term base with the essential terminology and phraseology, the processing of texts along with videos, presentations and so on, which will be explained in Chapters 3 and 4.

It is often the case that, depending on cultural issues, the source material may not be suitable for the target culture, therefore, this steps involve the creation and testing of new components which have to be made from scratch or fully adapted to the target locale.

Another very important task to make at this stage in the process is the creation of new set of keywords in order to index the site in the target locale. Hence, this process requires SEO knowledge and the use of proper tools. Since search engines are the primary method of navigation for most Internet users, basic SEO knowledge is considered as a useful tool for any web business. SEO, Search Engine Optimization, can be defined as the process of improving the visibility of a website (or a web page) so that it ranks well for particular keywords in a search engine's "natural" or "organic" search results (Ledford, 2009; Potts, 2007), in contrast to the visibility obtained through a pay-per-click (PPC) campaign.

Results have shown that it is the position of a website in the first search results page that is crucial for the website as it decides whether it is going to be read by a user. Search is the most important way users discover websites. If a website is absent from the top 30, it has almost no chance of being considered. The purpose of SEO is thus the evaluation of keywords to determine what users are interested in, in order to allow websites to be highly-ranked within results sets after a user enters a specific query term. For this reason, the choice of keywords becomes an essential asset for websites in order to be indexed in the search engines, and should be carefully selected by the translator in the localization process. Furthermore, there are textual elements that need to be translated in the deep (or coding) structure of each page, which has to be borne in mind by the translator. The final part of the process consists in quality assessment, where the translation is proofread and checked and the localized components are integrated into the website structure. Then,

after a series of functional quality tests, the web-ready version of the website is created and posted online.

As understood from the description of the various steps in the cycle, localizing a product is a process which requires a synergic endeavour where a wide range of professionals can collaborate, such as localizers-translators, localization engineers, managers, terminologists and quality assurance (QA) operators (Jiménez-Crespo, 2013: 29). Nevertheless, the complexity of this process is proportional to the nature of the project, mostly in relation to the resources available. Different types of localization processes can be identified, namely, large corporations, medium and small ones, volunteer-crowdsourcing and individual localization. As Jiménez-Crespo observes, localization is constrained by limited time, human and economic resources (Jiménez-Crespo, 2013: 33). For these reasons, the process is not monolithic, but it rather varies according to many levels and necessities.

Since Alfio Lago Gioielli is a small company, the available resources do not allow to carry out a full localization process which involves many agents, as for example in the above-mentioned case of Trollbeads. Therefore, the website is planned to be translated into English with its *lingua franca* function, in order to allow the website to reach the markets identified by means of the research mentioned at the beginning of this chapter. The planning of the translation process, focus of this dissertation, has been carried out by means of a study of different MT tools and the analysis of the subsequent post-editing process, whose methodologies will be analyzed with examples in the dedicated chapters.

## CHAPTER 2: Machine Translation

As argued in Chapter 1, Machine Translation has become an increasing presence in the work of translators, who consider it both as an aid and as a threat to their jobs. Indeed, in an era where the use and improvement of Artificial Intelligence (AI) continues to advance, the idea of a machine-ruled world seems less and less improbable. Such view is certainly disquieting on the one hand, as people are prone to consider things in a negative way. The language industry is a clear example of this negative view: as many have predicted that Machine Translation (MT) will eventually render human linguists obsolete. For this reason, much research has shed light on the way translators relate to machine translation and to their reaction toward its progress.

### 2.1 Overview of the History of MT

Language is man's most primitive means of communication. And I don't suppose I exaggerate when I say that today, more than ever before in the world's history, there is greater need for effective communication among the peoples of this planet. If we are to have peace in our time, the rapid exchange of scientific data, the complete sharing of ideas by all the members of the polyglot human family is absolutely essential. [...] Certain linguistic pioneers sought to bridge the gap. Father Johann Schleyer invented Volapük in the 1870's; Louis Lazarus Zamenhof created Esperanto in the 1890's. Other attempts were subsequently made. These somewhat unrealistic efforts to reduce an artificial means of international communication have met with but indifferent success." [...] We are now living in a distinctly mechanical age, and it is natural that we should seek to solve the problem by trying the means at hand. (Dostert, 1957: 1)

This snippet recorded from the welcoming remarks at the Eighth Annual Round Table Meeting on Linguistic and Language Studies of the Georgetown University proves that, in the first half of the twentieth century, scientists were already trying to bridge the gap among cultures by means of mechanical translation. In his overview of the history of MT, Hutchins explains that the first significant translation process was proposed in 1933 by the Russian Smirnov-Troyanskii (Hutchins 1995: 431). It was a three-staged process which could be defined as the envisioning of both bilingual and multilingual translation. First, a sort of logical analysis of words was carried out by an editor knowing only the source language; secondly, a machine was to transform sequences of base forms and functions into equivalent sequences in the target language; finally, the machine output was to be converted into the target language by another editor knowing only the target language. Such an ambitious project was ahead of his time and was unknown outside

Russia when, within a few years of their invention, the possibility of using computers for translation was first discussed by Warren Weaver of the Rockefeller Foundation and Andrew D. Booth, a British crystallographer.

The Machine Translation Archive reports a letter written in 1947 by Warren Weaver to Norbert Wiener, Professor of Mathematics at the Massachusetts Institute of Technology. The letter was introducing the concept of a computer designed to translate:

One thing I wanted to ask you about is this. A most serious problem, for UNESCO and for the constructive and peaceful future of the planet, is the problem of translation, as it unavoidably affects the communication between peoples. Huxley has recently told me that they are appalled by the magnitude and the importance of the translation job. [...] I have wondered if it were unthinkable to design a computer which would translate. (MT Archive, 1949: 4)

This idea was seriously considered in a memorandum dated February 12, 1948, written by Booth who was taking part in computer design and construction project at the University of London. It stated: “A concluding example, of possible application of the electronic computer, is that of translating from one language into another” (MT Archive, 1949: 6)

As Hutchins explains (1995: 431-445), not many years later, in 1951, Yehoshua Bar-Hillel was appointed as the first full-time researcher in MT at MIT. A year later, the first MT conference was convened, and the outlines of future research were already making clear what is still been discussed in the linguistic arena and will be the focus of the last chapter: namely, that human assistance was essential, either to prepare texts or to revise the output of machine translation. Such processes which were to be carried out only by humans were already known as pre- and post- editing.

In order to prove the feasibility of MT, experiments and research started at Georgetown University. When the US government learnt of the British effort – thanks to Alan Turing – to decrypt the Morse coded radio communications known as ‘Enigma’, which Nazi Germany used to send messages securely, they were inspired to try themselves post war, with the specific purpose of keeping up with Russian scientific publications. In January 1954, the first public demonstration of an MT system was the result of a collaboration between Dostert and IBM, where a sample of 49 Russian sentences was translated into English, using a very restricted vocabulary of 250 words and just 6 grammar rules. Despite its little scientific value, this project stimulated the large-

scale funding of MT research in the USA and inspired the initiation of MT projects elsewhere in the world, notably in the USSR.

From that year on, a mix of empirical and basic theoretical approaches was adopted in the development of MT, and research groups were established all over the world, including many European countries (France, Germany, Belgium, Hungary, etc.), Japan, China and Mexico. In the United States, the main activity had concentrated on English translations of Russian scientific and technical materials.

At the University of Washington, Reifler devised the word-for-word approach, involving the construction of large bilingual dictionaries; the RAND Corporation (1950-1960), on the other hand, emphasized statistical analyses, creating a process of continuous cycles of translation and post-editing and developing the first parser based on dependency grammar. Further development of his parsing method was continued by Garvin at the Ramo-Wooldridge Corporation from 1960 to 1967, focusing his research on a linguistic pattern recognition algorithm, defined dependency parser, which identified the fulcrum of a structure and the relationships of dependent elements to the fulcrum.

In a perspective that resembles later Chomsky's notion of universal grammar, Weaver launched a romantic metaphor imagining language as a city of towers, which explains how the base for rule based MT was built:

Think, by analogy, of individuals living in a series of tall closed towers, all erected over a common foundation. When they try to communicate with one another they shout back and forth, each from his own closed tower. It is difficult to make the sound penetrate even the nearest towers, and communication proceeds very poorly indeed. But when an individual goes down his tower, he finds himself in a great open basement, common to all the towers. Here he establishes easy and useful communication with the persons who have also descended from their towers. Thus may it be true that the way to translate from Chinese to Arabic, or from Russian to Portuguese, is not to attempt the direct route, shouting from tower to tower. Perhaps the way is to descend, from each language, down to the common base of human communication - the real but as yet undiscovered universal language - and then re-emerge by whatever particular route is convenient. (MT Archive, 1949: 11)

The so-called rule-based system was thus developed along two paths: the direct and the indirect approach (Baker and Saldanha 2009: 162). The first one is characterized by systems which base on bilingual dictionary entries and morphological analysis in order to translate pairs of languages word by word. In the latter, the system creates an intermediary, abstract representation of the meaning of the original source text, which is then translated in the output.

The second basic design strategy is the interlingua approach, which assumes that it is possible to convert source language (SL) texts into representations common to more than one language. The translation process thus develops in two stages: from SL to the interlingua (IL) and from the IL to the target language (TL).

As for the transfer approach, three stages are involved in the representation of the target language. Differently from the interlingua approach, this method adds an in-between stage where the SL texts converted in SL-oriented representations are transformed into equivalent TL-oriented representations, which then become the final output.

Despite the high optimism and the promise of great improvement in MT quality which characterized the 1950s, disillusion grew as the complexity of the linguistic problems became more and more apparent. In its 1966 report, ALPAC – the “Automatic Language Processing Advisory Committee” formed in the United States in 1964 by the United States government in order to evaluate the progress in computational linguistics in general and machine translation in particular – concluded that MT was “slower, less accurate and twice as expensive as human translation and that there is no immediate or predictable prospect of useful machine translation” (Hutchins 1995: 438). It predicted that there was no future for Machine Translation because of the problem of ambiguity that machine would have never been able to solve. The example of the word ‘pen’ became famous: according to the report, MT was not able and would have never been able to disambiguate words like ‘pen’, as a writing implement or an enclosure where animals are kept in. Though, as Hutchins observes, the report was considered short-sighted and biased, its influence was profound, as it brought a virtual end to MT research in the USA for over a decade and MT was for many years perceived as a complete failure.

While in the US research was confined to English translations of Russian scientific and technical materials, the European scenario was different, as the interest was concentrated on the growing demands for translations of scientific, technical, administrative and legal documentation from and into all the Community languages. Moreover, a huge demand for translation from English into French was caused by the Canadian government’s bicultural policy. Hence, the focus of MT research switched from the US to Europe and Canada, concentrating the principal experimental efforts of the decade on interlingua approaches. By the mid of the 1970s this approach was in doubt for

its ambition, and researchers widely accepted that the transfer approach might have offered better prospects.

In the 1980s, MT experienced a revival as a consequence of the appearance of new operational systems, and research expanded in many directions. One of the most successful operational system was SYSTRAN, installed in 1970 by the US Air Force for Russian-English translation, and in 1976 by the European Communities for English-French translation. The most sophisticated commercially available system during the 1980s was, however, the METAL German-English system, intended for the translation of documents in the fields of data processing and telecommunications. After the failure of its interlingua system, GETA (the Grenoble Groupe d'Etudes pour la Traduction Automatique) developed the Ariane system, which was flexible and modular in its conception of static and dynamic grammars. Single labelled tree structures were designed to incorporate different levels of representation, such as dependency, phrase structure, logic, and thus to provide considerable flexibility in multilevel transfer representations. Though it did not become an operational system, it was influential for many projects throughout the world in the 1980s, as for instance the Mu system, developed at the University of Kyoto under Makoto Nagao, later elaborated into an operational system used for the translation of abstracts by the Japanese Information Center for Science and Technology. In the same years, there was a revival in the research in interlingua, which saw innovative projects such as Philips' in the Netherlands, or Japan's multilingual multinational project involving many institutes all around Asia.

One of the best-known projects of the 1980s was a linguistics-based modular transfer system named Eurotra. This ambitious machine translation project established and funded by the European Commission from 1978 until 1992, had the purpose of attaining a fully automatic high-quality translation. The main motivation behind the funding of such project was one of the founding principles of the EU: to overcome the language barriers so that all citizens could read the proceedings of the Commission in their own language. For this reason, it had member groups distributed around the member countries. Way, Professor in Computing at the Dublin City University and one of the most important contributors to MT, explains how the Eurotra project was carried out (Cutting through the hype of Neural Machine Translation, 2017). Taking as example the translation from English into German in order to explain the Rule Based approach, Way

explains that his team had to write down a grammar of English and a grammar of German, and a contrastive grammar of how English representations could be mapped into German equivalent translational representations. In order to do this, monolingual experts of the source language were required along with monolingual experts of the target language, and the contrastive linguistic information in the middle. According to Andy Way, that method did not work “terribly well”, as it was very hard to write down specific rules of languages and get that result to map from one language to another.

## **2.2 From rule-based to statistical MT systems**

Since 1989, the dominance of the rule-based approach has been broken by the emergence of new methods and strategies that are now called “corpus-based” methods. (Hutchins 1995: 439). In that period, computers were becoming more and more powerful and, as a result, there was an increase in digital online content and, most importantly, the statistical paradigm came in. Corpus-based MT was developed as researchers began to explore the possibility of exploiting already translated texts as databases for automatic translation. This approach can be classified into two categories: statistical MT and example-based MT.

Statistical machine translation (SMT) generates translations using statistical methods based on bilingual text *corpora*. In this approach, a bilingual model is created where words and phrases are aligned as the basis for a ‘translation model’ of word-word and phrase-phrase frequencies. Given a source language sentence, statistical machine translation searches through all the target language sentences and finds the one with the highest probability. For this reason, building quality bilingual text *corpora* is essential to the success of SMT. The good quality of the translation depends on the number of human-translated documents available in a given language: the more of them, the better the quality – in fact, a minimum of 2 million words for a specific domain and even more for general language are required in order for a SMT engine to be trained (Systran 2018).

In order to produce the translation, the system selects the most probable words in the target language for each input word. Then, the machine has to determine the most probable sequence of the selected words on the bases of a monolingual “language model”. SMT’s biggest downfall includes it being dependent upon huge amounts of

parallel texts, its problems with morphology-rich languages (especially with translating into such languages) and its inability to correct single errors. For these reasons, its use was dismissed in the late 1960s.

After almost three decades, with the success of newer stochastic techniques in speech recognition, the IBM team at Yorktown Heights began to look again at their application to MT, reviving the statistical approach with its Candide project. Hence, it began building models of language which, as Way (2017) states, were considered heretical at the time, as the rule-based followers dominant at the time considered it ineffective and thought that translation could not be dealt with by looking at mathematical probabilities. The method involved first the alignment of individual words, word groups and phrases of the parallel texts, and then the calculation of probabilities that any one word in a sentence of one language corresponds to a word or words in the translated sentence. Surprisingly, this method outweighed all expectations, with almost half the phrases translated either matching exactly the translations in the corpus, or expressing the same sense in slightly different words, or offering other equally legitimate translations. Despite the sceptical forecasts, the statistical approach proved efficient, and the more it translated, the more it produced new documentation and more material to train the engines. In this way, the progress in statistical methods lead to the improvement of engines. Moreover, Way adds that, whereas rule-based systems would crash as soon as you typed in a sentence where it did not have the linguistic coverage, statistical systems would always give you some output. Thus, from the late 1980s until 2015 statistical machine translation was recognized as the dominant state-of-the-art paradigm.

The second major “corpus-based” approach is called the example-based (or memory-based) approach (EBMT), which also uses bilingual parallel *corpora* as its main knowledge base. With this approach, the input is compared with a *corpus* of typical translated examples, and translation is produced by extracting the closest matches and using them as a model for the target text. Three stages are involved in the translation process: the first is matching the input with the parallel corpus; the second is alignment, which involves identifying which parts of the corresponding translation are to be re-used, and the third is the recombination of the chosen parts of the examples to be used in a legitimate (or grammatical) way. Such approach gives prominence to the finding or recalling of analogous examples, assuming that the act of translating often involves

considering how a particular expression or some similar phrase has been translated before.

According to the *Routledge Encyclopedia of Translation Studies*, the most obvious distinction between rule-based MT and corpus-based MT is that, while RBMT is characterized by an effort to interpret – on various linguistic levels – the meaning of the source, CBMT is concerned with finding out the best matching patterns for source text and target text segments on the basis of an aligned corpus of translation examples. (Baker, Saldanha 2009: 162)

In the last few years, the differences between direct and indirect, transfer and interlingua, rule-based, knowledge-based and corpus-based became less useful for the categorization of systems. (Hutchins 1995: 440). Recent developments underline that MT research and MT systems adopt a variety of methodologies in order to tackle the full range of language phenomena, with its complexities of terminology and structure, misspellings, ‘ungrammatical’ sentences, neologisms, etc. Hence, hybrid machine translation combines multiple machine translation methods within a single machine translation system, as a result of the failure of any single previously described approach to achieve a satisfactory level of accuracy. The final translation output is generated by combining the output of all the sub-systems.

In the 1990s, the use of MT accelerated in order to meet the growing demand of large scale translations, primarily of technical documentation, from commercial agencies, government services and multinational companies. According to Hutchins, a notable impetus to the use of MT was due to the requirements of large computer software companies selling in international markets, as in order for companies to maintain competitive advantage, their documentation had to be translated quickly and accurately into the local language (Hutchins 1995: 443).

### **2.3 The era of Neural Machine Translation**

In the last four years, a new version of hybrid machine translation has emerged, which combines the benefits of rule-based, statistical and neural machine translation. The latter, which is a deep-learning based approach to MT, has made rapid progress and is beginning to displace its corpus-based predecessor, statistical MT. After a period in which NMT

implied extremely high costs in terms of research and implementation, the situation changed in 2015, to the extent that scientists and computational linguists have called the present time the new NMT era.

Neural Machine Translation is defined by Forcada as a “new breed of corpus-based machine translation” (Forcada 2017, section 2.1) as it requires huge *corpora* of SL and TL sentences to be trained. The innovation lies on the computational approach which has been introduced, namely, neural networks. The translator Cohen observed:

Scientific translation is the aim of an age that would reduce all activities to techniques. It is impossible however to imagine a literary-translation machine less complex than the human brain itself, with all its knowledge, reading, and discrimination. (Cohen 1949:14)

This claim anticipated what the present translating scenario has witnessed in the last four years, namely, the creation and improvement of translation machine tools exploiting an artificial intelligence which is able to learn and grow by means of data, like a toddler who is exposed to new input every day.

The first model of an artificial neuron was designed in 1942 by McCulloch and Pitts, and it is still the basis for most neural networks today. Devised as the neurons of the human brain, it consisted of a mathematical function comprising a set of inputs, a set of variable resistances, a processing element and a single output, a structure which could resemble human dendrites, synapses, neurons and axons.

One of the characteristics which seems to connect most of the advanced neural networks to biological neural networks is the adaptation to changing environment, and the emergence of ‘intelligent’ information processing functions in response to data by means of self-organisation.

Deep learning, also called hierarchical learning or deep structured learning, has emerged as a new area of machine learning research since 2006 (Deng et Al. 2014:198). The powerful capacity of feature learning and representation, due to their being conceptually modelled on the human brain, allowed deep neural networks (DNNs) to make big breakthroughs in fields such as speech recognition and natural language processing, and their architectures are becoming increasingly popular in the development of machine translation programs. By discovering intricate structures of huge *corpora* of data, deep learning allows machines to learn, indeed, how to change their internal

parameters and compute representations of input. (Bengio et Al. 2015: 436) As a result, huge quantities of data are necessary to train the strength of each of the connections between neurons so that the desired results – which refer to gold-standard translations – are obtained.

An artificial neural network is based on the interconnections between three types of nodes that exchange information:

I - *input*: the nodes that receive and process the signals coming from connections from previously active neurons or through sensors perceiving the environment (Schmidhuber, 2015: 86), adapting them to the internal nodes;

H - *hidden*: the nodes that carry out the real elaboration process through the use of algorithms, each one independently from the other. The output of the nodes in the Hidden layer depends on the outputs from the Input layer;

O - *output*: this layer, which is the last layer in the neuron, comprises the nodes that collect the results of the elaboration of the H layer and adapt them to the next block of neural network.

Feedforward neural networks (whose model is shown in Figure 11) are composed by three individual layers, which compose a basic model. More sophisticated, innovative neural networks may have more than one of any type of layer which can be built differently.

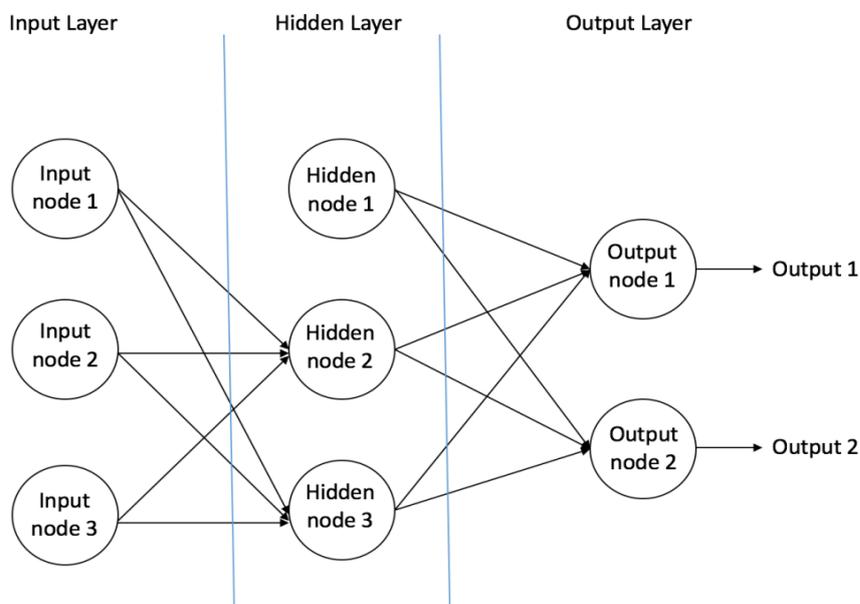


Figure 11: Example of a feedforward neural network

While SMT uses symbolic representations of words, meaning that when a word is written differently it will also be different for the system, NMT uses distributed representations, also defined as word embedding, in which words are encoded as vectors in a multidimensional space where similar words are semantically close to each other. For instance, words sharing the same part of speech will be grouped in one dimension, words of the same gender on another, negative or positive words on another, etc.

A neural network architecture develops within an encoder-decoder system. The encoder part of the system turns a sequence of words into a set of representations, which is recursively formed from the embedding of individual words. At each position of the target sentence being built, and for every possible word in the target vocabulary, the decoder provides the likelihood that the word is a continuation of what has already been produced. As Forcada (2017: 4) suggests, this process resembles a completion device, such as the features which are used to predict words in smartphone keyboards.

Hence, unlike in SMT, where translation is created by stringing together the translations of clearly identified subsegments, in NMT the raw translation is produced word by word taking the whole source segment into account. Indeed, while a SMT system consists of several subcomponents that are separately optimized, NMT employs only one neural network that is trained to maximize the conditional likelihood on the bilingual training data (Zhang et Al. 2015: 23).

Recurrent neural networks (RNNs) work by processing language sequentially in a left-to-right or right-to-left fashion. Reading one word at a time, this forces RNNs to perform multiple steps to make decisions that depend on words far away from each other. This model has been the top choice for language translation because of their high accuracy (Bengio et Al. 2015: 9). Nevertheless, in 2017 the Facebook Artificial Intelligence Research (FAIR) published a research introducing the first fully convolutional neural networks (CNN) model for sequence to sequence learning. According to the researchers, this CNN model is computationally very efficient and nine times faster than strong RNN systems, and it builds an alternative architecture for machine translation which opens up new possibilities for future text processing tasks (Gehring et Al. 2017: 1-8). This research demonstrated that CNN outperform the strong recurrent models, allowing to discover compositional structure in the sequences more easily as the representations are built hierarchically. Therefore, CNNs are much less sequential than RNNs, nevertheless, the

number of steps required to combine information from distant parts of the input still grows with increasing distance (Uszkoreit et Al. 2017). For this reason, the Google researchers initiated a new model, called ‘transformer’, which only performs a small, constant number of steps. A ‘self-attention’ mechanism is applied in each step, in order to directly understand the relationships between all words in a sentence, regardless of their respective position. First, the transformer generates an initial representation for each word. Then, by means of the self-attention mechanism it aggregates information from all of the other words, so that a new representation per word informed by the entire context is generated. This step is then repeated multiple times in parallel for all words, successively generating new representations. This new approach is currently studied and promoted by many researchers, to the extent that during the May 2018 EAMT – European Association for Machine Translation – annual conference (Agrawal et Al., 2018: 11-18) based their work on it, claiming that the ‘transformer’ architecture and contextual handling using ‘self-attention’ is a promising direction to explore in the future. In his article written on 3 September 2018, Senellart, Chief Scientist and CEO of SYSTRAN, explains that this current self-attention transformers (SAT) approach

allows the engines to “look” at several parts of the sentence simultaneously by identifying words that can have a significant impact on its understanding and translation. We are therefore moving closer to a human-like approach (Senellart 2018).

Claims like this may sound alarming to translators, as they seem to imply that the performance of machines will eventually eliminate their job and therefore their position in the society. The core question of this dissertation arises exactly from this concern, namely, what is left for human translators in a world where machines seems to be more and more accurate in their output.

In his paper, Forcada poses the question if NMT is better than SMT. As Bentivogli points out, NMT clearly outperforms all other approaches both in terms of BLEU and TER scores (Bentivogli et Al., 2016). BLEU, abbreviation for Bilingual Evaluation Understudy, is an algorithm for evaluating the quality of machine translated text created with the purpose of accelerating the MT R&D cycle because of the high cost and time-consuming human evaluation approaches. It is now the *de facto* standard in evaluating machine translation output, and relies on the idea that the closer a machine translation is

to a professional human translation, the better it is. (Papineni et Al., 2002) The range varies from 0-100, with 100 being the most similar to a human translation. TER score measures the amount of editing required from a MT output to exactly match a reference translation. Its aim is to find the minimum number of edits without generating a new reference (Snovel et Al., 2006). Therefore, it ranges from 0-1, where 1 is a sign of more post-editing effort.

In a 2016 research assessing the correlation between human judgements and the results obtained with automatic metrics for automatic post-editing (APE) systems evaluation – which consists in automatically correcting the errors present in a machine translated text – the reliability of these popular MT metrics was confirmed (Bojar et Al. 2016). As research demonstrates, the output generated by NMT is morphologically and lexically more correct than the one produced by the other systems. Moreover, a considerably lower post-edit effort is required with respect to the best PBMT systems (Bentivogli et Al., 2016).

As some research observed (Wu et Al., 2016, section 1), among the features which still needed improvement were the NMT's ineffectiveness of dealing with rare words, the long time and huge amount of data required to train the engine, and the failure to translate all words in the SL, due to sentence length – more than 30 words. (Bentivogli et Al., 2016) Nevertheless, many researchers have been studying and proposing alternative neural architectures to be implemented in order to solve these issues. For instance, to address the issue of long-sentences mistranslation, Bengio et Al. proposed a new architecture called Recurrent Neural Network search RNNsearch. This model, which is an extension of the conventional encoder-decoder, outperforms the conventional approach as it operates in terms of alignment: RNNsearch does not require encoding a long sentence into a fixed-length vector perfectly, but only accurately encoding the parts of the input sentence that surround a particular word (Bengio et Al. 2014, section 5.2.2).

Contributions like the one mentioned above prove that much improvement is still needed before reaching a 'perfect' output from machine translation. Nevertheless, the big leaders in translation software as well as world-leading search engines companies like Google, are investing on research on Neural Machine translation research and releasing updates year by year. A demonstration of how SMT and NMT work shall be given in the

next chapter, where I will translate snippets of text from the e-commerce website [www.alfiolago.com](http://www.alfiolago.com) and compare the output of different MT systems.

## **CHAPTER 3: Comparison of SMT and NMT tools**

After the presentation of the history and progress in MT technology, this chapter expounds on the MT tools that were analyzed to plan the translation project of the e-commerce website [www.alfiolago.com](http://www.alfiolago.com). SystranLinks and SDL Trados Studio were used in order to have an overview of CAT tools, i.e., software working on the basis of Translation Memories, which facilitates and speeds up the translator's work (Cocci 2007). After an explanation of their features by means of examples of translations of snippets taken from the website, new state-of-the-art Neural Machine Translation (NMT) tools will be compared in their performances.

### **3.1 SYSTRANLinks**

SYSTRAN, the market-leading machine translation solutions provider, was founded in 1968 as a result of pioneering research at Georgetown University, which, as mentioned in the previous chapter, created the first translation software from Russian to English. SYSTRAN, which now provides the technology for Yahoo! and Babel Fish among others, was also used by Google's language tools until 2007. Its engine, which for many years had been based on Statistical MT, was implemented with a hybrid rule-based and statistical machine translation technology with the release of SYSTRAN Server 7 in 2010. This new technology combines the strengths of both translation approaches: rule-based components guarantee predictable and consistent translations, while statistical components learn from existing monolingual and multilingual corpora. Therefore, thanks to this approach, the engine acquires knowledge as it is used. Among the many products offered by the software, I subscribed to SYSTRANLinks, a Content Management System (CMS) platform that allows to manage localization projects from a centralized base, which provides a rich range of user-friendly tools that allow to constantly enhance the content. After creating an account on SystranLinks, I was asked to verify the website [www.alfiolago.com](http://www.alfiolago.com) in order to allow the SYSTRANLinks version of the website to be publicly available. After setting the configuration information, such as source and target language, I set up a MT content provider, and SYSTRAN is enabled by default. When selecting this option, the system automatically displays the following sentence: "Waiting for human review or translation, SYSTRANLinks can provide automated translations for

your website”. Thus, it is clear from the beginning that the tool has to be understood as a computer aid for translators, which could never substitute their work.

In the content management suite, where translation rules can be added, all the pages known by SYSTRANLinks are displayed in the Pages menu list. The “sentence list” allows users to manage all text translations of the website. It shows all crawled sentences, and information about when they were crawled, along with their status, use and visibility.

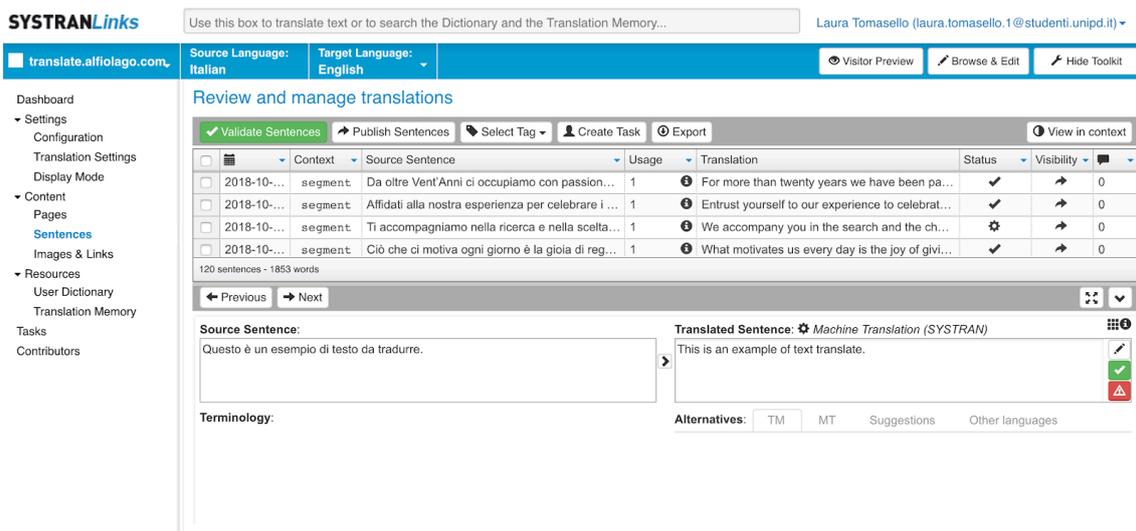


Figure 12: The sentences list in the SYSTRANLinks dashboard.

The sentence toolkit is where the translation editing process – which will be examined in depth in the next chapter – is performed. As shown in the following screenshot, the sentence in the source language is displayed on the left, whereas the translated sentence is displayed on the left. The translation is the one suggested by the MT – in this case, SYSTRAN’s Machine Translation.



Figure 13: Source Sentence and suggested translated sentence

When the sentence is post-edited, the new translation appears in the “translated sentence” space. Alternative translations are shown below, namely, from the MT engine, from the

Translation Memory, from community feedback (suggestions) and also from other languages.



Figure 14: Source Sentence, edited sentence and alternative suggestions

The screenshot above displays a sentence which was translated by the MT and then successively edited and validated by me by clicking on the green check icon. Each time a sentence is modified and then validated by the editor, the original Machine Translation alternative is displayed below. The resources list allows the users to access the features called User Dictionaries and Translation Memories, which are the typical features of a CAT tool.

### 3.1.1 User Dictionary

User Dictionaries allow users to locate desired subject matter terminology, in order to customize the translation before giving the input to the MT engine. A new entry can be simply added by filling in the 'Source' and 'Target' fields and clicking 'Add', as shown below:

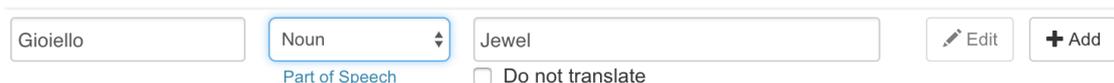


Figure 15: Creation of a terminology database

To adapt translations to specific terminological needs, it is also possible to single out words that should not be translated, labelled DNT entries (Do Not Translate) by the system. This feature avoids the translation of company names, proper names, locations, trademarks or any titles or expressions that should not be translated. Employing this feature allows translators to save a lot of time, as it prevents them from spending time and effort in correcting all the instances in which a DNT word is treated by the MT as a

common word and thus translated. The proper name “Alfio Lago”, for instance, was literally translated as “Alfio Lake”, along with Italian jewellery brands like ‘Comete’ or “Ti Sento” which were turned into “Like you” and “I hear you”. Hence, when I set DNT words I considered all the brands names, the proper name “Alfio Lago”, the location information and the email addresses.

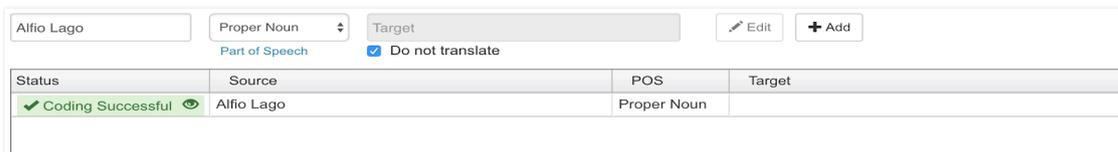


Figure 16: Creation of a new DNT rule in the User Dictionary

As the screenshot shows, when “Alfio Lago” was added as Do Not Translate term, the translation output changed as the terminology panel recognized this new rule, which is displayed in the green left panel saying “coding successful”.



Figure 17: MT translation produced by means of the User Dictionary

Other coding principles can be used in order to set specific rules, such as defining common sequences, forcing gender or number, or link verbs to specific syntactic contexts. A very useful feature, which I used a lot, is named “Protected sequences”, which enables users to set which fixed expressions are not to be inflected, in order to be translated exactly as entered in the dictionary.

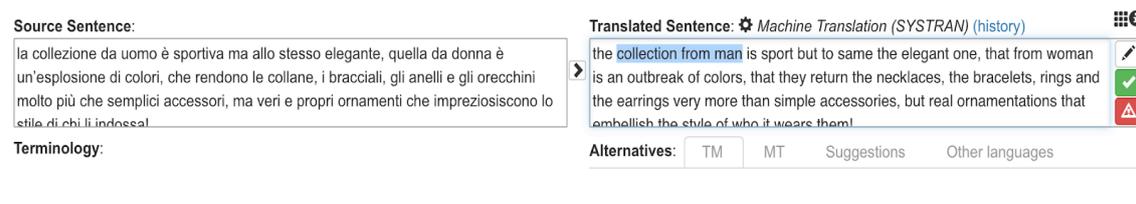


Figure 18: MT translation containing an error

The screenshot above displays the machine translation suggested by SYSTRAN. As shown, “collezione da uomo” is translated as “collection from man”, which suggests that the algorithm trained by statistical data is coded in such a way that it translates all Italian prepositions ‘da’ into the English preposition of place ‘from’. Hence, I created a rule in the User Dictionary, forcing the engine to translate “collezione da uomo” into “men collection”, treating it as a fixed expression. Therefore, I formulated the new coding by following the system’s requirements, thus entering the words between quotation marks and specifying their grammatical category.

As shown below, once the addition is correctly registered by the User Dictionary, the translated sentence is corrected along the new lines:

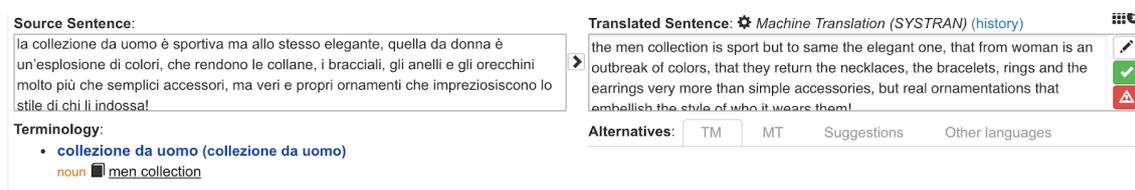


Figure 19: MT translation is corrected after creating a new code in the User Dictionary

In order to build my own terminology database, I used a program called Extraggio, presented on the occasion of the conference “TranslatingEurope”, held in Rome on 26 October 2018. Extraggio is a product by Babelscape, a startup company founded in 2016 at the University La Sapienza, which focuses on the use of multilingual Natural Language Processing in order to overcome language barriers by means of a unified large-scale multilingual knowledge repository and semantically-enhanced text comprehension systems. According to research conducted by Euromonitor International (“Voice of the Industry: Digital Consumer”, 12 June 2018), Natural Language Processing, which is comprised in the area of Artificial Intelligence, will be a key powering technology reshaping the world by 2040, together with machine learning.

The program Extraggio is designed to process texts in order to extract key concepts and entities involved in a text and interconnect them; to find to which domains the texts belong – namely, the fields of knowledge, and assign a sentiment to the texts. The system provides a combination of statistical and semantic techniques. The key terms in the input text are identified by means of statistical machine learning, and they are linked to concepts and entities by means of Comprehendo, a word sense disambiguation program

that deals with semantic text understanding. Terms, concepts and entities are ranked by importance, and then the domain and sentiment information conveyed in the text are provided. Thanks to these features, knowledge can be extracted from texts, which can help translators be more consistent in conveying the source message and meaning. In my translation project, I used Extraggo to understand which were the most frequent words that, if mistranslated by MT tools, would have cost me a lot of time and effort because of their need of editing. Understanding which words are the most frequent allowed me to create a terminology database in order to train the MT engines.

The About Us page text is reported below as instance to show how the program works. The text reads:

#### PERCHÉ SCEGLIERCI

##### Passione e Ricerca Della Bellezza

Da oltre Vent'Anni ci occupiamo con passione dei Gioielli e soprattutto, delle Persone. Ciò che ci motiva ogni giorno è la gioia di regalare e vivere con i nostri Clienti autentiche Emozioni. Ti accompagniamo nella ricerca e nella scelta dei materiali e del design, mettendo in primo piano le tue esigenze, perché ogni Cliente è per noi unico e speciale. Affidati alla nostra esperienza per celebrare i tuoi momenti importanti: acquistando un gioiello Alfio Lago stai scegliendo tra un'accurata selezione di pietre preziose e materiali di Massima Qualità, nel rispetto della migliore tradizione Made In Italy. Nel nostro Catalogo puoi trovare le migliori firme di Gioielleria, collezioni di pregiate marche di Oreficeria e Orologeria e Accessori Fashion; oltre ad una varia selezione di Articoli Di Design, Complementi d'Arredo e Vetri d'Arte Moderni. I nostri servizi di Consulenza Gemmologica e Laboratorio Orafo E Orologiaio possono dare forma alle tue idee, creando prodotti personalizzati con cura e attenzione; oppure riportare il tuo gioiello al suo splendore originale. Partecipare agli avvenimenti più emozionanti della vita dei nostri Clienti e sapere che, con il nostro lavoro, abbiamo contribuito a regalare loro un Momento Speciale, è da sempre la nostra più grande sfida e gratificazione.

The program Extraggo works taking a text (or a collection of texts) as input and ranking the key concepts and entities, as well as domain and sentiment information. Once I inserted the text above in the system, the program displayed the following information:

TOPIC	momento	ricerca	passione
WHO	Clienti	Massima Qualità	Made In Italy
WHERE	Gioielleria		

*Figure 20: The key information extracted by means of the software Extraggo which relate to the topics, people and locations contained in the analyzed text*

The image shows that the main topic identified by the system are ‘momento’, ‘ricerca’, ‘passione’; that the protagonists are ‘clienti’, ‘qualità’ and ‘made in Italy’ and the place is ‘gioielleria’. Among the listed named entities are: ‘clienti’, “massima qualità”, “made in Italy”, ‘design’, “laboratorio orafo”, ‘gioielleria’, ‘catalogo’ and ‘oreficeria’. The concepts ranked by the system are: ‘momento’, ‘ricerca’, ‘passione’, ‘emozioni’, ‘materiali’, “migliori firme”, “selezione di articoli”, “articoli di design”, ‘gioia’, ‘esperienza’, ‘utente’, ‘unico’, ‘esigenza’, ‘scelta’, ‘pietra’, ‘collezione’, ‘orologiaio’, ‘attenzione’, ‘gratificazione’, ‘prodotto’, ‘avvenimento’, ‘vita’.

The image below is the graphic representation of the semantic net of the keywords that were recognized by the system. By hovering over the words, the system displays an explanation of the word, which is taken from the references which build the database. For instance, when clicking on “Made in Italy”, the following explanation appears: “Made in Italy è un marchio commerciale che indica che un prodotto è completamente progettato, fabbricato e confezionato in Italia”, which, translated into English, means that “Made in Italy” is a trademark indicating that the whole process of a product – design, manufacture and packaging – is completely carried out in Italy.

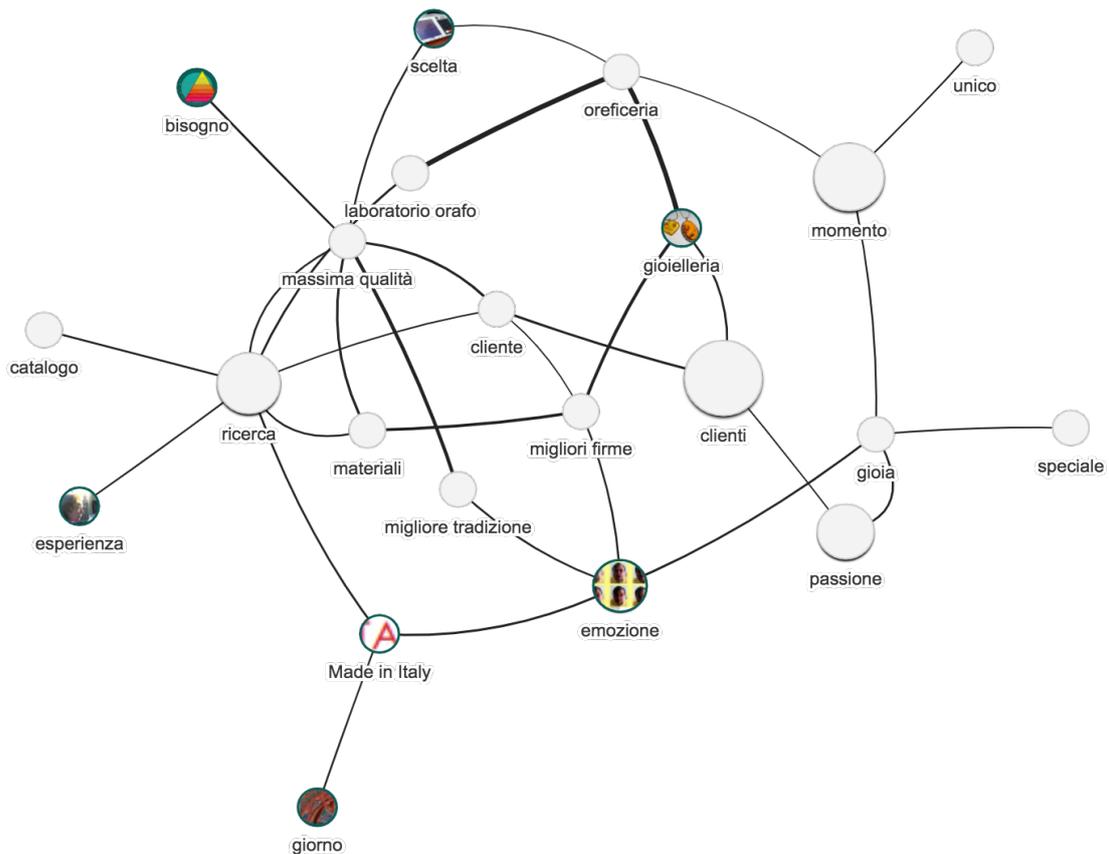
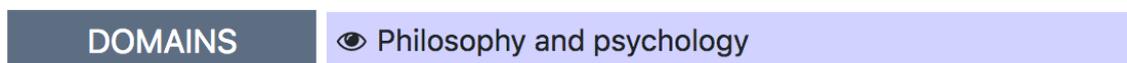


Figure 21: Representation of the key concepts in the “About Us” page text by means of Extraggo

The results of this analysis indicate that the About Us page in [www.alfiolago.com](http://www.alfiolago.com) is highly human centered, putting first customers, emotions and quality. Indeed, the main domains attributed to the texts by the system are philosophy and psychology, which means the translator will have to shape the translation according to these domains.



*Figure 22: The main domains attributed to the text*

The use of Natural Language Processing programs like Extraggo, despite its being a new product that still needs improving, might prove useful for translators in order to find semantically related nets. Moreover, this semantic conceptualization of terms, along with their explanation, might be very useful when the translator has to disambiguate terms whose meaning is fuzzy and unclear. Once I found the most important keywords by means of Extraggo and I decided that these words would have had one unique translation for my target domain, I created my terminology database in the User Dictionary. The image in the next page displays the graph created by Extraggo for the keywords in the ‘Returns’ page in [www.alfiolago.com](http://www.alfiolago.com) – which provides users with necessary information about product returns and refunds.

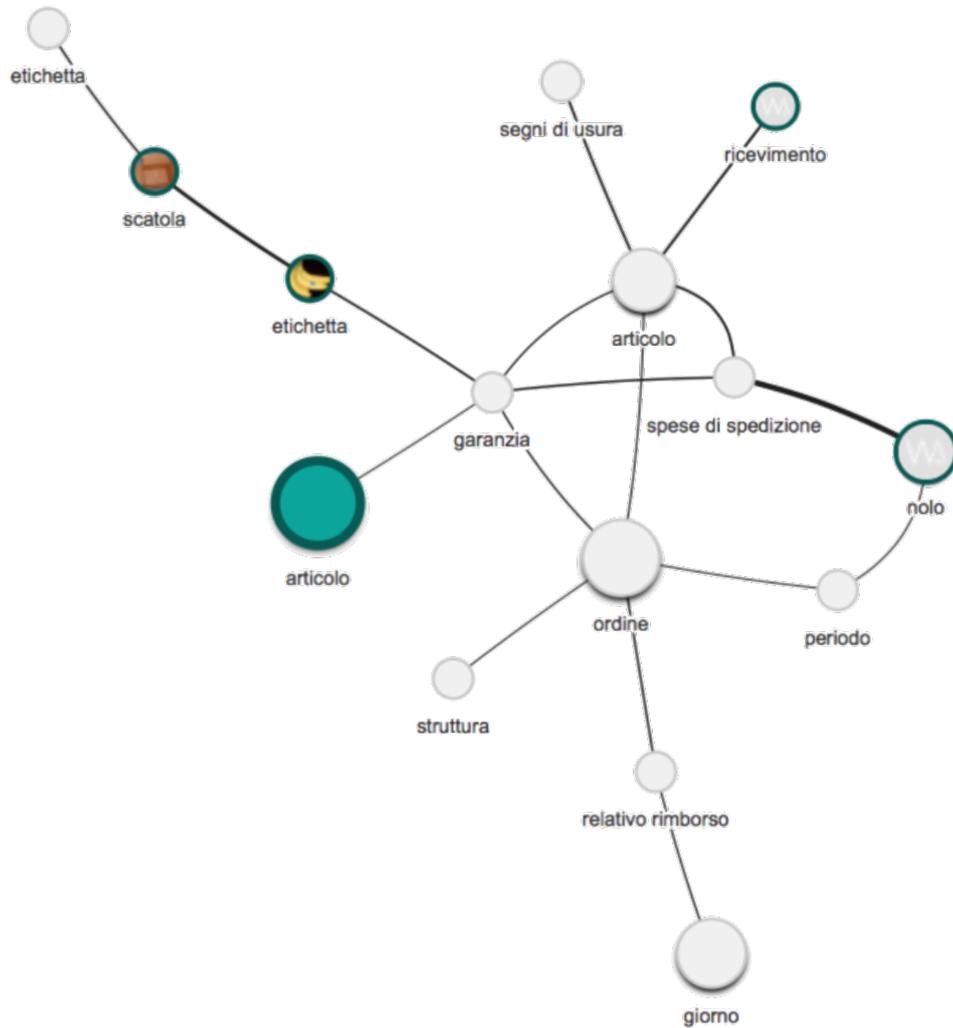


Figure 23: Graphic representation of the key concepts in the ‘Returns’ page text

After extracting the most important words and concepts, such as “spese di spedizione” ‘etichetta’, ‘garanzia’, ‘ordine’, ‘rimborso’ and so forth, I built my terminology database which is partly displayed below:

Status	Source	POS	Target	Confidence
✓ Coding Successful	rimborso	Noun	refund	██████████
✓ Coding Successful	articolo	Noun	item	██████████
✓ Coding Successful	scatola	Noun	box	██████████
✓ Coding Successful	garanzia	Noun	warranty	██████████
✓ Coding Successful	etichetta	Noun	label	██████████
✓ Coding Successful	ordine	Noun	order	██████████
✓ Coding Successful	reso	Noun	return	██████████

Figure 24: Screenshot of the terminology database created by means of Extraggo

Hence, the most recurrent keywords along with brand names and other DNT words were inserted in my User Dictionary. As a result, the machine was able to translate the source input according to the new rules, which implied I saved a considerable amount of time since I was no longer obliged to correct all instances in which the MT tool mistranslated these words.

### **3.1.2 Translation Memory**

The other feature included in the system resources together with the User Dictionary is Translation Memory. The idea of Translation Memories (TMs) was first proposed in 1980 by Martin Kay and described the following year by Arthern with these words:

It must in fact be possible to produce a program which would enable the word processor to 'remember' whether any part of a new text typed into it had already been translated [...] Any new text would be typed into a word processing station, and as it was being typed, the system would check this text against the earlier texts stored in its memory [...] (Arthern, 1931: 318)

However, TMs became commercially available in the mid-1990s (Somers, 2003: 33). These are databases of previous translations that have been pre-translated can usually be consulted by translators usually on a sentence-by-sentence basis, and used as a model. During the translation process, TM entries are matched with sentences in the source text. A database of translation examples, defined as “aligned parallel corpus” by linguists, is a prerequisite for a TM system, and it can be created “as you go along” (Somers, 2003: 33) with the translation or by uploading an external parallel list.

Translation Memories can be used both when post-editing sentences – where they are displayed as TM matches as alternative translations in the Sentence Toolkit – and in the Sentences Menu, where sentences with an exact match in the memory (and not yet reviewed) will have the status TM Exact Match. The Translation Memory tab contains all sentences that were manually edited/validated on the website, and sentences from imported files.

The matches can be exact, full or fuzzy, depending on the degree of similarity between the source text (ST) and the TM database. An exact match means that the ST segment is identical to a segment stored in the memory, while in a full match the ST segment matches one stored in the memory with differences only in ‘variable’ elements

such as numbers, dates, time, etc. Fuzzy matches occur when ST segments are similar to segments in the memory, and they can be re-used with some editing.

Confirming a word in the TM implies that it never has to be translated again, since the TM has stored and remembered the translation. Therefore, every time a translator comes across the same term in the documents or other documents, the translation is automatically recalled and confirmed by the TM. Hence, it can be said that tools like TMs and User Dictionaries enable translations to be more consistent and translators to be more productive, since they will only have to translate the sentence once. For this reason, “the ability to recycle or leverage previous translations using Translation Memory Systems has been a milestone in the history of localization” (Baker and Saldanha 2009: 158).

### **3.2 SDL Trados Studio**

The second CAT tool that was tested is SDL Trados Studio, which works similarly to SYSTRANLinks. Among the main services provided by SDL suite, SDL Trados offers a complete environment which integrates machine translation and post-editing into its translation workflow, allowing to manage translation projects, edit or review translations, and organize terminology. As with SYSTRANLinks, when the appropriate parameters are set, a machine translation of a translation unit is inserted by SDL Trados Studio if no match is found in the translation memory. Then, the translator is free to post-edit the machine translation.

The image in the next page is a screenshot of a snippet of text translated with the SDL Online Translation Editor. As the image shows, a Translation Memory is created as soon as a sentence is validated by the translator (which is indicated by means of the green checks on the right) in the same way as with SYSTRANLinks.

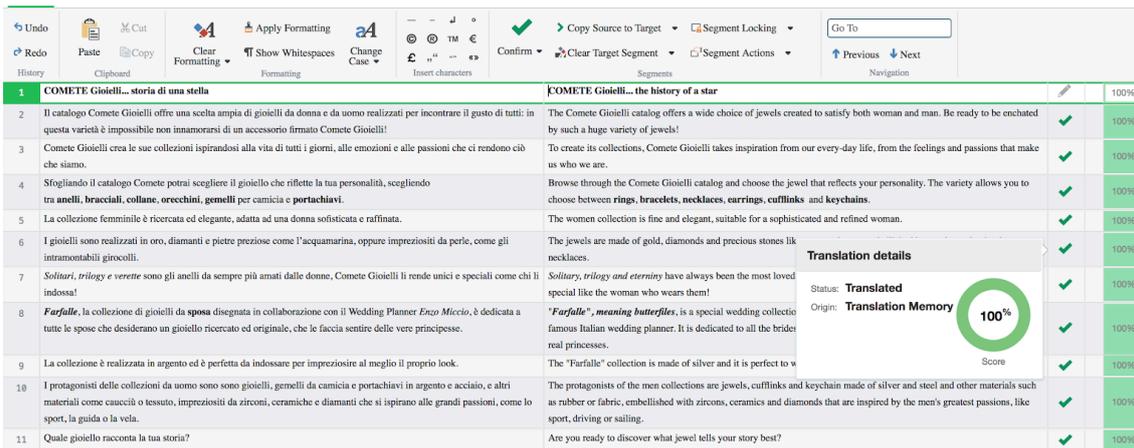


Figure 25: Screenshot of the SDL Online Translation Editor dashboard showing the functioning of a Translation Memory

Despite the features of these MT programs, which allow users to speed up the translation process, such as translation memories or user dictionaries, the translation performed by the SMT engines is not flawless and requires a lot of post-editing. The mistakes spotted and the necessary changes to be made will be analyzed in the chapter devoted to post-editing, whereas, in the next section, I will expound on the difference between statistical MT tools and the new state of the art paradigm, namely Neural MT tools.

### 3.3 SYSTRAN's Pure Neural Machine Translation

In this section I will compare the translated output of SYSTRAN's Pure Neural Machine Translation and other three Neural MT tools, namely, Google Translate, Amazon Translate and DeepL.

After being based on SMT for more than 40 years, at the end of 2016, SYSTRAN launched its neural engine named PNMT (Pure Neural Machine Translation), the first commercial translation engine based on AI and deep learning and offering, as their product service description claims, "tremendous translation quality" (SYSTRAN Pure Neural Server, 2018). Thanks to the technology based on Deep Neural Networks (DNN), which has been outlined in the previous chapter, the Pure Neural Machine Translation engine is trained to learn language "as a child does" (Senellart 2018), as the algorithm, progressing step by step, corrects its parameters during the training phase. When the source input is translated, the generated output is compared to the expected reference and

corrective feedback is sent 'backward', which is what enables the network connections to adjust and improve translation quality. It must be noticed that the disclaimer in the information section of the Pure Neural Machine Translation demonstrator advises that the engines shown in the demonstrator are a first step, and they will continuously be improved.

The most common issues with poor translation results performed by the demonstrator regard the poor translation of some short sentences (or single words); the reformulation or truncation of very long sentences and issues with entities (both numeric or named ones), and other issues which are not of interest for this project as are related to other languages such as Arabic or Japanese. The translation outcome, despite being far from a human-like translation, is much better than the translation performed by the statistical based system used by SYSTRANLinks. The following example compares the MT output of the two different systems:

Source text:

Partecipare agli avvenimenti più emozionanti della vita dei nostri Clienti e sapere che, con il nostro lavoro, abbiamo contribuito a regalare loro un Momento Speciale, è da sempre la nostra più grande sfida e gratificazione.

SYSTRANLinks output:

To more participate to the moving events of the life of our Customers and knowledge that, with our job, we have contributed to give they a Special Moment, is from always our greater challenge and gratification.

SYSTRAN PureNeural MT output:

Participating in the most exciting events of our clients' lives and knowing that, with our work, we have helped give them a Special Moment, it has always been our greatest challenge and gratification.

This comparison sheds light on the great improvement of NMT with respect to the previous approach. Though not perfect yet, the NMT output is impressively better than the one produced by SMT, which contained much more grammar and lexical mistakes.

Improvements can be noticed as regards:

- verb construction: to participate vs participating

- use of the right part of speech: where SMT used the noun ‘knowledge’ for the Italian ‘sapere’, the NMT understood that in that context ‘sapere’ was a verb, therefore it translated it with ‘knowing’;
- right verb tense: “è da sempre” cannot be translated with the present tense, as the SMT does with “is from always”, but rather with the present perfect “has always been”, as the NMT correctly does;
- use of the right pronoun: where SMT did not recognize the object pronoun ‘loro’ by putting ‘they’, the NMT used the correct ‘them’;
- use of the right term in the right context: in Italian lavoro can be translated with ‘work’ and ‘job’, but whereas ‘job’ is a specific occupation/profession, ‘work’ refers to general efforts and activities done to accomplish a goal. In this case, the NMT recognized the correct meaning of the Italian ‘lavoro’ and translated it with job.

### **3.4 Other state-of-the-art NMT tools**

The wave of NMT systems is growing fast and more and more Neural Systems are being developed and can be used to manage translation projects. Google Translate is probably the best known all over the world. As Vintaloro wrote in his article for the magazine *Tradurre*, until a few years ago, using Google was the last thing a translator would have thought of as its output was a pastiche of mistakes and mistranslations. In 2016, however, the old SMT approach was abandoned and the new Google Neural Machine Translation (GNMT) was introduced (Wu et Al. 2016). This new engine is able to learn from millions of examples of reference human translations, such as those in the EU, UNO, NATO websites and so on. The massive improvement of Google NMT compared to the previous SMT has therefore transformed Google Translate into a helpful tool for translators.

Amazon Translate was presented to the public at the AWS Summit in San Francisco on 4th April 2018. As pointed out by Friedman, the Amazon Translate Product Leader, the problem with statistical models is that they do not understand context, while with Neural MT tools it is no longer the case. On the occasion of the AWS Summit, Friedman displayed two different translations of the review of a pocket knife from German into English.

The older version with SMT was:

Really a very good Pocket knife. Had yesterday after breakfast something poppy between the teeth. Because I once again found no toothpicks, I ordered mine without further ADO this pocket knife. The integrated toothpick (Nr. 3) is very stable and very quickly I could clean my teeth. Super! To the rest I can tell nothing unfortunately because I him not be emergency.

Neural MT version:

Really a very good pocket knife. Had a little poppy between the teeth yesterday after breakfast. Since I didn't find a toothpick again, I ordered this pocket knife shortly. The integrated toothpick (No. 3) is very stable and I could clean my teeth very quickly. Great! I can't say anything about the rest because I don't need it.

As shown in the previous example with Systran's Pure Neural MT and as will be shortly shown also by means other snippets of texts extracted from [www.alfiolago.com](http://www.alfiolago.com), the Neural MT output is much more accurate and fluent than the SMT output.

The fourth and last tool that will be considered in the comparison is DeepL Translator, which was launched in August 2017 by DeepL GmbH, a startup company supported by Linguee. Despite being a very new product, it has been ranked higher than Google Translator and its competitors in terms of precision and fluency, producing an output closer to human references than the other ones. This claim will be shortly clarified by means of a comparison of the four NMT tools.

### **3.5 Comparison of SMT and NMT tools**

This section will compare the different outputs from the MT systems described so far, shedding light on their differences and similarities with respect to the analyzed texts. The source texts shall be provided and then the different translations shall be displayed and analysed. The first snippet that will be focus of my analysis is a sentence taken from the description page of the brand Comete Gioielli in [www.alfiolago.com](http://www.alfiolago.com):

Farfalle, la collezione di gioielli da sposa disegnata in collaborazione con il Wedding Planner Enzo Miccio, è dedicata a tutte le spose che desiderano un gioiello ricercato ed originale, che le faccia sentire delle vere principesse.

The following lines correspond to the translation produced by SystranLinks:

Butterflies, the collection of jewels from spouse designed in collaboration with the Wedding Planner Enzo Miccio, are dedicated to all the spouses who wish a searched jewel and original, than make to feel them of the true princes.

SDL Trados output:

Butterflies, the jewellery collection from bride designed in collaboration with the Wedding Planner Miccio Enzo, is dedicated to all the wives who want a jewel researched and original, which face feel real princesses.

Despite making the same recurrent pattern mistakes – which shall be analyzed in more depth in the next chapter dedicated to post-editing machine errors – it can be noticed that Systran and SDL outputs differ in some aspects. For instance, contrary to SYSTRANLinks, SDL correctly spots that the word ‘collection’ is singular and therefore uses the singular verb ‘is’; on the other hand, it makes a semantic mistake when translating the Italian subjunctive ‘faccia’ with the noun ‘face’.

Let’s now focus on the output of NMT tools. The following sentence is the output of SYSTRAN’s Pure Neural MT:

Farfalle, the collection of wedding jewelry drawn in collaboration with the Wedding Planner Enzo Miccio, is dedicated to all brides who want a desired and original jewel, making her feel true princesses.

Amazon Translate output:

Farfalle, the collection of wedding jewelry drawn in collaboration with the Wedding Planner Enzo Miccio, is dedicated to all brides who want a desired and original jewel, making her feel true princesses.

Google Translate output:

Farfalle, the collection of bridal jewelry designed in collaboration with the Enzo Miccio Wedding Planner, is dedicated to all the brides who want a refined and original jewel that makes them feel like real princesses.

DeepL output:

Farfalle, the bridal jewelry collection designed in collaboration with Wedding Planner Enzo Miccio, is dedicated to all brides who want a refined and original jewel, that makes them feel like real princesses.

It can be noticed that SYSTRAN's PNMT and Amazon provide two identical translations. The result is clearly better than SMT translations, i.e.:

- NMT tools use the correct words taking the context into consideration: though 'spouse' can be translated both with 'brides' and 'wives', there is a semantic difference between the two words, in that 'brides' refers to a woman who is about to get married or has just got married, whereas 'wife' is the woman to whom a man is married. In this context, the collection of jewels is designed to be worn during the wedding day, therefore 'brides' is the correct word.

- NMT does not make basic grammar mistakes such as translating with 'than' the Italian relative pronoun 'che', which is referred to the jewels.

Hence, the NMT translation is much more fluent and accurate than SMT, nevertheless, both SYSTRAN and Amazon made a mistake in translating "che le faccia sentire delle vere principesse" with "making her feel true princesses", meaning that the algorithm did not recognize the plural *nuance* of 'le'. Another mistake can be observed in the wrong use of the word 'desired' for 'ricercato'. In this case, the Italian word does not mean 'wanted, sought after', but 'refined'. As for Google Translate, the translation appears smoother and more accurate, especially in the final part of the sentence. There is a mistake where the proper name Enzo Miccio is treated like an appositive adjective: "the Enzo Miccio Wedding Planner". The translation by DeepL is the one which sounds more natural and flawless.

Another sentence will be considered in order to check the validity of these assumptions. The source sentence is taken from the description page of a watch brand called Bering:

La collezione Max René di Bering è pensata a chi non si accontenta di un orologio, ma ne vuole due in uno! Infatti con pochi semplici passaggi potrai cambiare il cinturino scegliendo il colore che preferisci e donare un nuovo look al tuo orologio Bering!

#### SYSTRANLinks output:

The Max René collection di Bering is thought to who it is not satisfied of a clock, but of it wants two in one! In fact with little simple passages you will be able to change to the strap choosing the color that you prefer and to donate a new look to your Bering clock!

#### SDL Trados Studio output:

The collection Max René Bering is designed to who is not satisfied with a clock, but it wants to two in one! In fact with a few simple steps you can change the strap by choosing your favorite color and give a new look to your clock Bering!

The two outputs present may flaws both in morphology, syntax and lexis. A taxonomy of the most recurrent error from MT will be provided in the next chapter.

#### SYSTRAN's Pure Neural MT output

The Max René collection of Bering is thought of who's not satisfied with a watch, but he wants two in one. In fact, with a few simple steps you can change your belt by choosing the color you prefer and giving a new look to your Bering watch!

The translation is certainly more fluent and much more accurate than the one produced by SMT, however it presents some inaccuracies, such as the use of 'belt' instead of 'strap' for the word 'cinturino', or the use of the -ing form in 'choosing' where the base form of the verb was required by the use of the coordinator 'and' to link the two clauses. Moreover, the punctuation was not respected strictly, as one of the exclamation marks was transformed into a full stop. It must be remembered, however, that these inaccuracies might be related to the fact that the tool I used is a demonstration, and the disclaimer in the information section warns against possible issues in the translation, such as the reformulation or truncation of very long sentences.

#### Amazon Translate output:

The Bering Bering's Bering collection is designed for those who don't want a watch, but want two in one! In fact, with a few simple steps you can change the strap choosing the color you prefer and give a new look to your Bering watch!

The translation does not show any mistake, apart from a very bizarre issue at the beginning of the sentence, represented by the repetition of Bering. Instead of translating the words “La collezione Max René di Bering” into “The Max René collection by Bering”, the output repeats the word Bering three times. Considering this issue very bizarre, I expanded upon the problem and discovered that it might be caused by the difficulty of the engine to elaborate long sentences. As Bengio points out, one of the issues of the encoder–decoder approach of artificial neural networks is that their necessity of compressing all the necessary information of a source sentence into a fixed-length vector may make it difficult for the neural network to cope with long sentences, especially those that are longer than the sentences in the training corpus (Bengio et Al., 2016). Therefore, I tried shortening the source text by feeding the engine with a shorter input:

La collezione Max René di Bering è pensata a chi non si accontenta di un orologio, ma ne vuole due in uno!

In this way, Amazon’s translation was correct:

The Max René collection by Bering is designed for those who are not satisfied with a watch, but want two in one!

This result may be due to the fact that Amazon Translate is not using the previously described transformer architecture yet. As Agrawal and his colleagues from the FBK observed at the May 2018 EAMT (European Association for Machine Translation) annual conference, being typically trained at sentence level, neural networks fail to completely capture implicit discourse relations established at the inter-sentential level in the text. In their paper, they demonstrated that considering the whole context in the source text during translation by using the self-attention transformer architecture leads to better performance than translating sentences in isolation. In order to be sure that the intuition was correct, I tried with other texts, where the same pattern (“la collezione “Name of The Collection” di “Brand Name”) was repeated:

Source text:

*La collezione Italia di Trollbeads* è pensata a chi non si accontenta di un gioiello, ma ne vuole due in uno! Infatti con pochi semplici passaggi potrai cambiare il orecchino scegliendo la forma che preferisci e donare un nuovo look al tuo gioiello!

Amazon output:

The *collection* is designed for those who are not happy with a jewel, but want two in one! In fact, with a few simple steps you can change the earring choosing the shape you prefer and give a new look to your jewel!

As shown by the output, the NMT does not recognize the pattern and therefore it cuts the words “Italia di Trollbeads”, translating only “the collection”. Thus, I repeated the experiment by shortening the input and transforming it into:

La collezione Italia di Trollbeads è pensata a chi non si accontenta di un gioiello, ma ne vuole due in uno!

The engine rephrased the sentence and translated it as follows:

The Trollbeads Italia collection is designed for those who are not satisfied with a jewel, but want two in one!

It can be noticed, therefore, that when the input is shortened, Amazon NMT does not have any issues and translates correctly. When I did a third test expecting the same result to appear, something different happened instead. As I was only changing the first part of the source test into “la collezione Farfalle di Comete”, I expected the output to change and mistranslate it as in the previous instances, nevertheless, the translation appeared as follows:

The Farfalle collection by Comete is designed for those who are not satisfied with a jewel, but want two in one! In fact, with just a few few quick things you will be able to change the earring by taking the form you prefer and donate a new look to your jewel!

This happened as the word combination “La collezione Farfalle di Comete” had been previously used. Therefore, the engine had stored it into its Translation Memory. The proof of this assumption is that when I changed “la collezione Farfalle di Comete” into

“la collezione Farfalle di Trollbeads” – which had never been used before –, the output became “The Butterflies collection by Trollbeads”, so the engine did not recognize the name “Farfalle” as it had previously done, since it was not related to the word “Trollbeads”.

Below are the translations by Google and DeepL:

Google Translate output:

The Max René collection by Bering is designed for those who are not satisfied with a watch, but want two in one! In fact, with a few simple steps you can change the strap by choosing the color you prefer and give a new look to your Bering watch!

DeepL output:

The Max René collection by Bering is designed for those who are not satisfied with one watch, but want two in one! In fact, with a few simple steps you can change the strap by choosing the color you prefer and give a new look to your watch Bering!

The two translations are identical apart from the more accurate use of ‘one’ instead of ‘a’ by DeepL in the part “satisfied with one watch”. As discussed earlier, these two systems are adopting self-attention transformer neural networks, which are trained significantly faster than recurrent architectures and also show improvement in translation quality. (Agrawal et Al., 2018)

It is worth noticing that the source text contains an inaccuracy in the sentence “La collezione [...] è pensata a chi”, as the proper preposition to be used instead of ‘a’ would be ‘per’. Interestingly, whereas SYSTRANLinks, SDL and SYSTRAN PNMT repeated the inaccuracy producing the mistranslations “The collection [...] is thought *to* who” (SYSTRANLinks), “The collection [...] is designed *to* who” (SDL) and “The collection [...] is thought *of* who” (SYSTRAN PNMT), Amazon, Google and DeepL were able to recognize the context and all of them correctly translated the sentence into “The collection [...] is designed *for* those”.

These examples show that pre-editing performed by human translators is necessary in order not to provide SMT systems with a confusing input, whereas it might not be necessary with NMT, unless the text contains obvious misleading information. In the

‘Returns’ page, for instance, there is a sentence that contains a verb pattern which resulted difficult to disambiguate for all systems. The source text reads:

Se desideri riparare o sostituire un Gioiello o un Orologio acquistato in uno dei nostri e-shop, ti preghiamo di contattare il nostro Servizio Clienti e includendo il tuo numero d'ordine inviare una foto dell'articolo. Non preoccuparti, se non disponi del tuo numero d'ordine ti aiuteremo a trovarlo.

SystranLinks output:

If desires to repair or to replace a Jewel or a Clock acquired in one of ours e-shop, we pray you to contact our Service Customers and including your number of order to send a photo of the article. Not to worry to you, if you do not have your number of order we will help to find it you.

SDL Trados Studio output:

If you want to repair or replace a Jewel or a Watch purchased in one of our e-shop, please contact our Customer Service and including your order number to send a photo of the article. Do not worry if you do not have your order number will help you to find it.

SYSTRAN’S PNMT output:

If you want to repair or replace a Jewelry or a Watch purchased in one of our e-shops, please contact our Customer Service and include your order number to send a picture of the item. Don't worry, if you don't have your serial number, we'll help you find him.

Amazon Translate output:

If you wish to repair or replace a Jewel or Watch purchased in one of our e-shops, please contact our Customer Service and including your order number send a photo of the article. Don't be concerned, if you don't have your order number we will help you find it.

Google Translate output:

If you wish to repair or replace a Jewel or Watch purchased in one of our e-shops, please contact our Customer Service and include your order number to send a picture of the item. Do not worry, if you do not have your order number we will help you find it.

DeepL output:

If you wish to repair or replace a Jewel or Watch purchased in one of our e-shop, please contact our Customer Service and including your order number send a photo of the item. Don't worry, if you don't have your order number we'll help you find it.

All the systems apart from DeepL and Amazon mistranslated the sentence “e includendo il tuo numero d'ordine inviare una foto dell'articolo”, as they understood the verb ‘inviare’ as a final clause, namely “in order to send”. The verb is instead an imperative form, as it is coordinated by ‘and’ to the previous verb “contact us” preceded by ‘please’, which anticipates an imperative.

In order to see whether pre-editing would have changed the performance of the NMT systems, I disambiguated the Italian sentence by changing the word order and transforming it from “e includendo il tuo numero d'ordine inviare una foto” into “e di inviarti una foto dell'articolo includendo il tuo numero d'ordine.” As soon as the change was applied, the output of SYSTRAN PNMT and Google Translate resulted correct.

SYSTRAN PNMT output:

Please contact our Customer Service and send us a picture of the item including your serial number.

Google Translate output:

Please contact our Customer Service and send us a picture of the item including your order number.

Hence, it can be concluded that human-related tasks such as pre- and post-editing continue to be necessary steps in the translation process, and they will still be a requirement to avoid certain mistakes in the output even with the newest state-of-the-art Neural MT.

It is interesting to notice that most NMT do not provide a unique translation to the input, but they rather offer a variety of synonyms and phrases that the algorithm finds suitable for the context. The screenshot below represents the several options provided by DeepL for the word “looking for”, which can be chosen by the user to edit the translation. The options provided are all related to the same semantic field “looking for something”,

namely: ‘searching’, ‘seeking’, ‘in search’, ‘interested’, ‘looking’, “in the market”, “after ideas”.

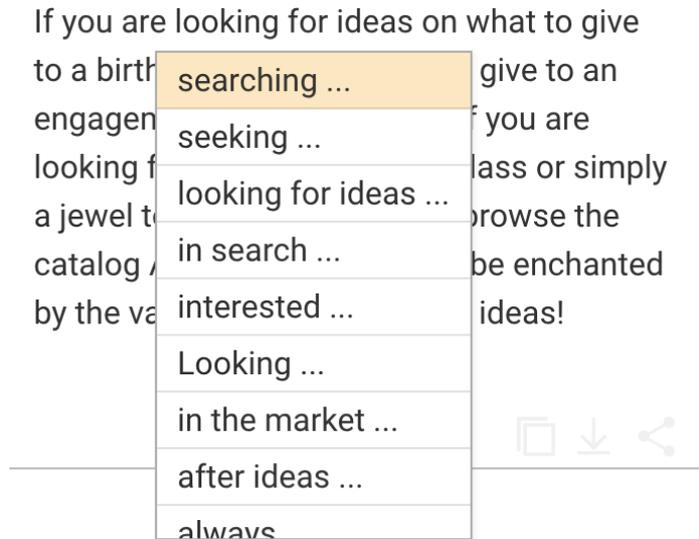


Figure 26: Translation suggestions provided by the DeepL algorithms

As already mentioned, a great issue in machine translation is the relevance of context, and the difficulty encountered by the machine in detecting the right word for it. When I had to translate the polysemous Italian word ‘fedi’, for example – which in this context refers to wedding rings – it was more difficult for the machine to provide a correct translation, since the word was separated from its context. Nevertheless, NMT engines are now fed with a huge amount of data, therefore the algorithms are trained to recognize patterns and context, so that the tools are enabled to provide different synonyms which can be chosen according to the context. Where a SMT tool (SYTRANLinks) translates ‘fedi’ with the plural ‘faiths’, NMT tools like Google Translate and DeepL recognize that the word ‘fede’ is polysemous in Italian and does not refer only to a belief, therefore they provide different options:

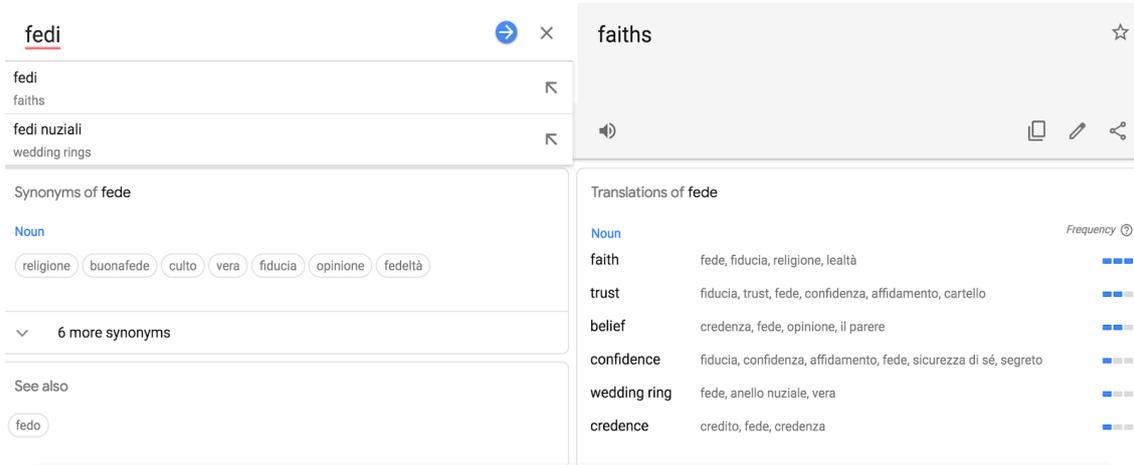


Figure 27: Translation suggestion of the word 'fedi' provided by Google Translate

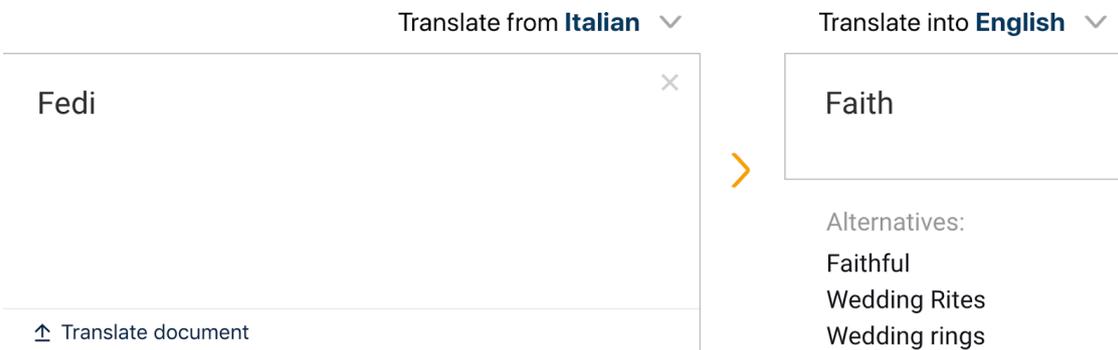


Figure 28: Translation suggestion of the word 'fedi' provided by DeepL

In conclusion, even though the examples shown do not represent a sufficient amount of data in order to prove which system performs better than the others, they can provide some confirmation to research that has shed light on the fact that NMT outperforms SMT in terms of grammar and morphology (Bentivogli et Al., 2016). Moreover, it was demonstrated that NMT translations are much closer to a human translation than those produced by SMT. It must be borne in mind, however, that NMT systems continuously ask translators to improve their output, so that the engine can learn.

### 3.6 Crowdsourcing and Translation Communities

A related topic which is beginning to attract much debate among professionals is crowdsourcing, or user-generated translation. This might qualify as a core theme for a

future translator and interpreter curriculum that is attentive to the issue of ethics, which will be dealt with in Chapter 5 among the intelligences that will be required to thrive in a future dominated by AI.

The image below displays SYSTRAN’s PNMT request to improve its output, which appears when the translator hovers over any word in the MT output.

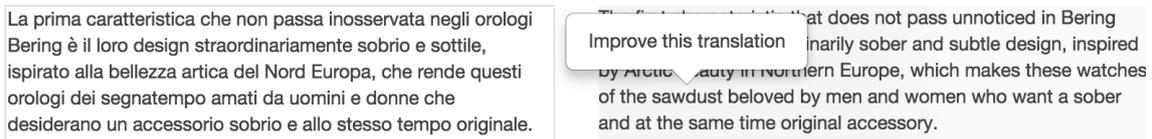


Figure 29: SYSTRAN PNMT request to improve its output

A further example of user-generated translation can be found in the Google Translate Community. When a translation is displayed in Google Translate, for instance, the user can click on the output, which shows the sentence “improve this translation”. The text is then editable and accompanied by the following sentence: “Your contribution will be used to improve translation quality and may be shown (without identifying you) to other users”. When the edit is submitted, the output text becomes orange and the user can click on a link to be sent to the translation community. Once entered in the Translation Community, users can translate or validate words, expressions or phrases in their own languages. When I selected English and Italian, I was sent to the dashboard that is shown below:

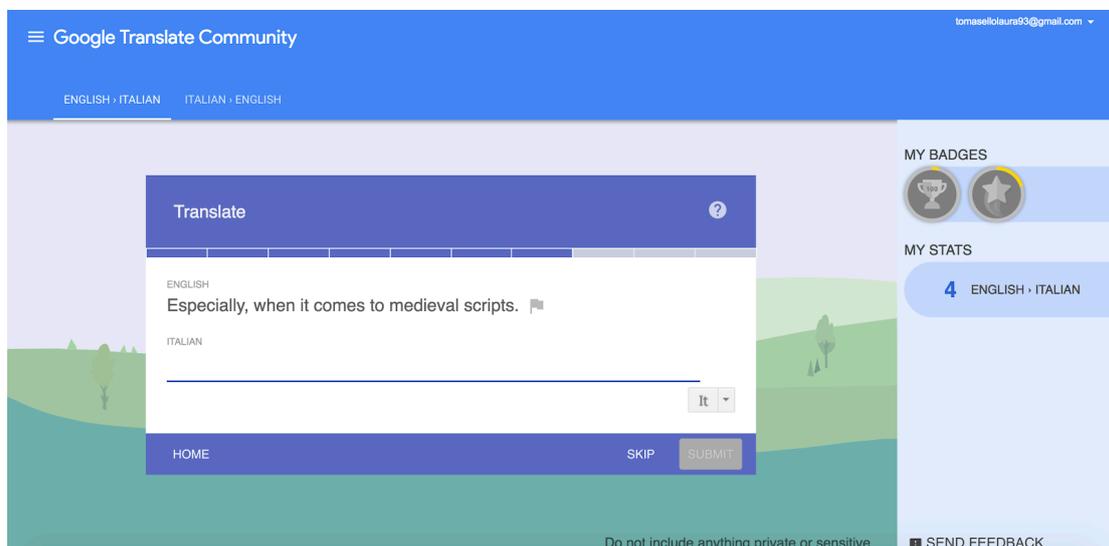


Figure 30: The Google Translation Community dashboard

A series of sentences of different length is displayed and users are asked to translate them with some suggestions, namely, to translate the word or phrase according to how they would say or write it, and leave some aspects unchanged, such as upper and lower case letters, tone (e.g. formal or informal), idiomatic and slang expressions. Moreover, should the users miss important information like the subject's gender, they are asked to translate the sentence as they think it should be written. Once the option 'Submit' is clicked, the translations are saved and credits are added to the user's statistics.

This system, where each Google user is responsible for the generation of content, allows everyone to become a contributor, a teacher and trainer of the neural algorithm. Consequently, the relevant data which are added to the references will consist in further golden standards for future translations containing a similar input.

As Lowndes observed during the "Translating Europe Forum" held in Brussels on 8-9 November 2018, the most unprecedented factor about AI is that everybody opensources the information, sharing the code they are using, each one contributing to the improvement of the other. For this reason, AI is experiencing an unprecedented progress, which implies constant daily updates in all fields (Lowndes 2018). Certainly, all the novelties brought by new technologies and crowdsourcing give rise to many questions, and translators feel threatened by the current hype about AI. It is necessary to point out that pre-editing precautions are necessary in order to avoid possible mistranslations produced by MT, and the neural engines' request to improve their output suggest that not only is human contribution necessary as a correction of machine tools, but it is the only way by which machines can improve. For this reason, the positive impact that NMT may have on the general perception of translation and the transformation of this job will be analyzed in Chapter 5 in order to raise awareness about all the issues connected to multilingualism and language use as a fundamental factor not only to foster democracy and social inclusion, but also "to involve translators in this process, thus responding to their wish of being more active and taking part in shaping contents they are interested in". (European Commission, 2012: 37)



## CHAPTER 4: The human factor in translation

### 4.1 The Post-editing Process

As shown in the previous chapter, MT contributes to a great extent to the job of translators, allowing them to speed up the translation process. Nevertheless, the machine output is far from perfect, therefore human intervention is required.

Post-editing is the process in which the human translator, after receiving the translated text automatically generated by the machine (namely, the output), amends it by correcting and improving it. According to trends and predictions (CSA Research 2018), post-editing will gain even more importance in the work of translators in the years to come. According to a 2016 study by Lommel and DePalma, companies tend to increase their investment in post-editing machine translation (PEMT), i.e. the use of machine translation to produce a first draft of the translation to be corrected later, and will translate or pretranslate 59% of their content with automated translation by 2019 (CSA Research, 2016). The same research predicted a doubling of the total number of words translated between 2016 and 2019 with a doubling of the automatically translated part (with or without post-editing), without excluding an increase in the human translation component, which, contrary to expectations, will increase as well.

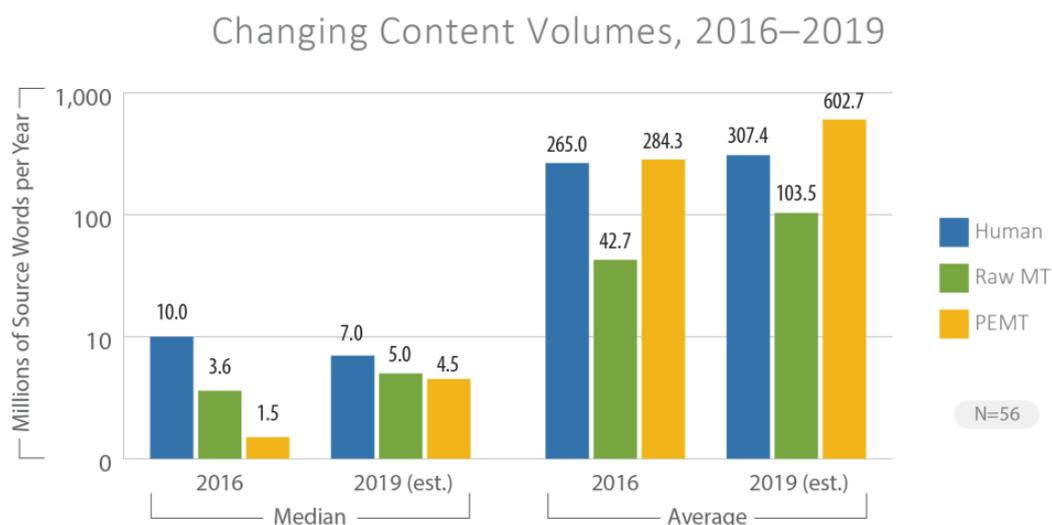


Figure 31: The growth of post-edited automated translation in professional translation. Source: Lommel and DePalma, Common Sense Advisory Inc, 2016)

During his 2017 conference on the conflict over technology in the translation workplace, Mossop dealt with the theme of translation and the impact MT has on the translation process. His research was led by some thorny questions such as: what is the degree of control of translators' own work if the translation memory (TM) is constantly finding the wording for them? In addition, has the status of translators in the society been decreased or enhanced by the use of MT? Mossop focused his interviews on the feelings of translators towards MT, claiming that there has been more attention focused on its economic and technical aspects but less to how it affects professional and social satisfaction.

The research was conducted by means of surveys with close questions and open comments questions. Showing the answers of his interviews to translators, he described their reaction towards MT. He compared the results of a survey he conducted in 2011 and one in 2017. According to the answers in 2011, one of the main common issues among translators is the feeling of frustration resulting from having to fix up the fuzzy matches found by MT, or to complete the translation where sentences or parts of it have been pre-translated by MT. Moreover, the quality of the translation decreased with the use of MT. The range of answers updated in 2017 showed that MT tools are better in ensuring consistency than quality. Thus, quality is one of the issues that mainly worries translators, who consider their work threatened by MT. Nevertheless, the interviews shed also light on positive reasons for liking MT.

According to the 2011 results, the main reason behind the positive attitude towards MT is the fact that it allows to translate more texts in less time, hence granting translators the chance of making more money; furthermore, it provides new translation ideas that translators might have never thought of. One last and useful aspect of MT is that, if the database includes other people's translations – such as the possibility of a community feedback – seeing other translations increases the translators' confidence in the quality of their final decision. In 2017, the reasons for liking TM included the fact that it is an excellent source of terminology and, as stated above, it makes consistent use of terminology much easier.

Hence, there is an enormous range of different and even conflicting opinions about MT: while some translators consider it as frustrating and time consuming, others see it as a chance to increase their proficiency. All the same, most of translators seem to

acknowledge the main issue in relation to MT is the lack of quality in the MT output. Technology does indeed increase the production speed but at the same time it distorts the question of quality.

As Bentivogli explained in her speech during the “TranslatingEurope” Workshop in Rome on 26th October 2018, there are two scenarios where MT is a support to translators who are required to edit the machine output, namely, light post-editing and full post-editing. Full post-editing (PE) is the most important and controversial. The important prerequisite when PE is required is that the final result must be perfect. Therefore, neither content nor form or style can be ignored. It is therefore used in all cases where effective communication is necessary. Light PE occurs when a human translator takes a MT output and corrects it, ensuring that the message is preserved and ignoring stylistic or fluency necessities. According to Bentivogli, light PE can be used to correct the MT of online help pages, knowledge forums, support documentation and so forth. In the case of an e-commerce website, stylistic or fluency necessities can be ignored in product pages, where the user is interested in finding specific information rather than focused on the style. A product page of [www.alfiolago.com](http://www.alfiolago.com) is displayed below.

ORECCHINI DONNA SWAROVSKI 5382364 LILIA ROSÈ

SWAROVSKI

Codice:  
5382364

SPEDIZIONE IMMEDIATA

Puoi riceverlo entro tra **giovedì 31 gennaio** e **lunedì 4 febbraio** se ordini prima di **5 ore e 19 minuti** spedito con **DHL Express**

Stai guardando l'ultimo articolo disponibile. Non lasciartelo sfuggire!

Spedizione Gratuita Pacchetto Regalo Compreso 30 Giorni per Restituire

79,00 €

AGGIUNGI

Figure 32: Product description page in the e-commerce website [www.alfiolago.com](http://www.alfiolago.com) (updated January 2019)

The description below the product picture (which is not displayed in the image) reads:

Orecchini donna SWAROVSKI 5382364 Lilia bianco placcato oro rosa. Per questa stagione, mischia le carte con questo femminile paio di versatili orecchini. Il design senza tempo scintilla in metallo placcato oro rosa e motivi di farfalle in pavé. Gli orecchini sono indossabili corti o nella versione più lunga, con le catenine pendenti applicate. Prova lo stile asimmetrico per l'inconfondibile scintillio firmato Swarovski con un tocco contemporaneo. Sono disponibili articoli abbinati. Chiusura a perno a pressione. Lunghezza cm 6.5.

As can be noticed, its purpose is to provide information about the product, whose technical information is provided in the 'Details' section:

<b>Tipo di Orecchini</b>	Pendenti
<b>Genere</b>	Donna
<b>Marca</b>	SWAROVSKI
<b>Modello</b>	Lilia
<b>Materiale Principale</b>	Metallo
<b>Materiali</b>	Metallo
<b>Dimensioni</b>	cm 6,5
<b>Chiusura</b>	Perno a pressione
<b>Garanzia</b>	Internazionale SWAROVSKI
<b>Confezione</b>	Originale SWAROVSKI

*Figure 33: Product details in a product page of www.alfiolago.com*

In a product page, therefore, features like style and fluency are not a priority, whereas accuracy is necessary as it is the part where users look for specific information that cannot be misleading.

The translation proposed by SYSTRANLinks is:

Earrings 5382364 woman SWAROVSKI white Lilia plated pink gold. For this season, fray the papers with this feminine pair of poured them earrings. The design without time spark in plated metal pink gold and reasons of butterflies in pavé. The earrings are indossabili courts or in the longer version, with the hanging necklaces applied. It tries the asymmetric style for the unmistakable signed flashing Swarovski with a contemporary touch. They are available bound together articles. Closing to hinge to pressure. Length cm 6.5.

It can be noticed that the translation has plenty of errors, from technical terms like ‘Chiusura a perno a pressione’ to semantically mistranslated words like ‘reasons’ instead of ‘motifs’ for the Italian ‘motivi’, to literal translation of multiword expressions like “senza tempo”, which is wrongly translated into “without time”. Words for which the program cannot find an equivalent are transferred in the original Italian (‘pave’ and ‘indossabili’). The translation suggested by a NMT system like DeepL, for instance, is:

Women's earrings SWAROVSKI 5382364 Lilia white rose gold plated. For this season, shuffle the cards with this feminine pair of versatile earrings. The timeless design sparkles with rose gold plated metal and pavé butterfly motifs. The earrings can be worn short or in the longer version, with the pendant chains applied. Try the asymmetrical style for the unmistakable sparkle signed Swarovski with a contemporary twist. Matching items are available. Press stud closure. Length 6.5 cm.

In this output, the most important technical information is correctly translated, as well as the multiword expressions such as “senza tempo” or idioms like “shuffle the cards”. Consequently, NMT can be efficiently employed to translate product pages with light PE or even without post editing effort (PEE). As will be shown at the end of this chapter, the great shift in MT brought by neural networks and machine learning, will enable translators to build custom models to train the machine algorithm in order to produce better translation outcomes. On the other hand, when fluency and style are essential criteria to consider in order to give a satisfying user experience, full PE is required. Full PE will be described in the next sections.

The assessment of the quality of MT output has been the focus of much research, and it is essential to understand the degree of importance of human contribution in the translation process. As Hutchins and Somers point out in *An Introduction to Machine Translation* (Hutchins and Somers, 1992: 163), the most obvious criteria to consider when assessing the quality of a translation are fidelity or accuracy, intelligibility or clarity, and style. Many different definitions and degree of importance have been given to these tests. The first one, accuracy, measures the extent to which the translated text contains the “same” information as the original. Intelligibility or clarity, which is one of the most frequently used metrics of the quality of output, assesses the ease with which a reader can understand the translation, which may be affected by grammatical errors, mistranslations and untranslated words. T.C Halliday, for whom comprehensibility and intelligibility are

synonymous, proposed a measurement of intelligibility on a 4-point scale, where the degrees ranged from very intelligible, fairly intelligible, barely intelligible and, lastly, unintelligible (Dabbadie et Al, 2002 :14). As for style, it relates to the extent to which the translation uses the language appropriate to its content and intention.

In his book *Editing and Revising for Translators*, Mossop (2007) provides principles as guides to action in order to instruct people who manage translation services but are not themselves professional translators. For this project, I used this guide as a reference to post-edit the output of MT. The textual components analyzed for the purpose of this dissertation were therefore amended along the lines proposed by Mossop. Hence, the process began with the structural editing of the whole text followed by the analysis of the content for factual, mathematical and logical errors. Subsequently, the stylistic editing and copyediting were performed and, finally, the consistency check.

#### **4.1.1 Structural editing**

Structural editing refers to structural adjustments made to the text, for instance by changing the order of sentences to emphasize a concept, or by changing paragraph or sentence divisions, and so forth. Where sentences were too long or redundant, as in the example above, I tried to write something simpler:

Dagli ornamenti da giorno senza tempo come il bracciale tennis Emily, agli intramontabili solitari, agli orecchini colorati fino alle biro o penne usb, ogni trimestre Swarovski presenta nuove collezioni dal tocco glamour ed elegante, per tutti i gusti e le necessità.

First, I divided the sentence into two parts, then I changed the order of the sentences putting the clause “Every quarter Swarovski presents new collections with a glamorous and elegant touch” in the first place in order to emphasize the continuous innovation of the catalogue. In addition, I rephrased the sentence by using the pronoun ‘you’ in order to make the reader feel more involved. Thus, the final translation appears as follows:

Every quarter you will find new collections presented with a glamorous and elegant touch by Swarovski. All tastes and needs can be satisfied by a Swarovski jewel, from timeless day ornaments such as the Emily tennis bracelet to timeless solitaires, colourful earrings, pens and usb pens.

Another instance of structural editing is found in the parameter called ‘completeness’ (Mossop, 2007: 128). Translators are usually required to render the whole of the source message text, following the NANS principle – No Additions, No Subtractions. However, in some cases some additions or subtractions are inevitable, as the information in the translation might not be so important to the target language users. In the “About Us” section, for instance, I decided to cut some words that sounded redundant:

Nel nostro Catalogo puoi trovare le migliori firme di Gioielleria, collezioni di pregiate marche di Oreficeria e Orologeria e Accessori Fashion;

The translation suggested by SYSTRANLinks MT was:

In our Catalogue you can find the best brands than Jewelry shop, collections of valuable brands of Jewellery articles and Clockwork and Accessories Fashion;

Leaving aside grammar and lexical mistakes – which shall be dealt with in the next paragraphs – the translation sounds redundant since the words ‘jewellery’ and ‘brands’ are repeated twice. The repetition is due to the fact that the word ‘oreficeria’ is translated with the broad name ‘jewellery’ in English, therefore I set it as translation parameter (together with ‘brand’ instead of ‘signature’) in the User Dictionary. To solve the problem of redundancy, I opted for the following solution:

In our Catalogue you can find the collections of the finest jewelry and watchmaking brands, along with the trendiest fashion accessories;

It can be noticed that, along with merging ‘gioielleria’ and ‘oreficeria’ into one single expression, I also added the word ‘orologeria’ putting ‘collection’ at the beginning of the sentence.

#### **4.1.2 Content editing**

Content editing is generally intended as correcting large scale texts for their ideas. As Mossop (2007: 80) points out, translators are not usually concerned with the macro-level content editing, but rather with tasks like the correction of errors that can be factual, logical and mathematical. Referring to the parameters identified by Hutchins, this step in

the editing process refers to the improvement of intelligibility or clarity (Hutchins and Somers, 1992: 163). Mathematical errors are a common result of carelessness; factual errors may refer to incorrect addresses, telephone numbers or email addresses, wrong organization names and conceptual errors in general, while logical errors include contradictions, nonsense and tautologies. As shown in the previous chapter, sometimes the MT output was so badly written that the more convenient way to process the text was to abandon the existing one and re-express the content. This procedure is referred to as rewriting (Mossop, 2007: 30), which is different from editing in that the output is completely abandoned in favour of a new version from scratch. An example can be retrieved from the following sentence describing the jewellery brand Amen, whose jewels are dedicated to prayers, angels and religious icons:

Un bracciale da portare al polso non solo come simbolo religioso, ma pensato per essere un accessorio di abbigliamento, un must have sia per l'uomo che per la donna.

The SMT output is:

A bracelet to not only carry to the wrist like symbol religious, but which thought for being an apparel accessory, a must have is for the man who for the woman.

The translation is not intelligible and therefore needs to be rewritten from scratch:

Though being a religious symbol, this bracelet is designed to be a clothing accessory which has become a must have for both men and women.

There are instances where minor rewording is sufficient, for example, where a content is originally targeted at an audience of native users and needs adjusting for an international audience of non-native users. Let's take an example from the website. As already mentioned, the charms produced by the fashion jewellery brand 'Trollbeads' are sold all over the world, nevertheless there are some collections that are culture-related. One of the charms that can only be found in Italy, for example, is called 'Caprese', and its product description says:

Caprese, simbolo della cucina napoletana, abbina perfettamente i 3 colori della bandiera Italiana. Il tricolore è un simbolo di libertà e d'unione per l'Italia. Scegliendo questo beads racconterai non solo la tua passione per il cibo italiano ma, dimostrerai anche, quanto sei attaccato alla tua terra. Viva l'Italia!

The translation suggested by DeepL is:

Caprese, symbol of Neapolitan cuisine, perfectly matches the 3 colors of the Italian flag. The tricolour is a symbol of freedom and union for Italy. By choosing this bead you will tell not only your passion for Italian food but, you will also show how attached you are to your land. Long live Italy!

It can be observed that the machine output is accurate and does not contain any grammatical mistakes. Therefore, it could be accepted as a suitable translation for a product description. Nevertheless, there is a cultural-related problem, namely, the sentence “By choosing this bead you will tell not only your passion for Italian food but, you will also show how attached you are to your land. Long live Italy!”

The problem that emerges with regard to this sentence is that, if the purpose of internationalizing an e-commerce website is to reach visitors from all over the world, a non-Italian reader would feel excluded, as such a description is directed towards Italian citizens. The problem could be fixed by preventing non-Italians from purchasing this product by excluding its online-sale. Nevertheless, this would mean losing income as there might be people interested in buying this product. The solution, therefore, lies in rephrasing the translation by adjusting it to an international audience. Therefore, a very small yet essential transformation was made to the sentence, changing the possessive adjective ‘your’ into the demonstrative adjective ‘this’. The final result is, therefore:

By choosing this bead you will tell not only your passion for Italian food but, you will also show how attached you are to this land. Long live Italy!

Another instance of sentence rewording is represented by the following lines, which have already been analyzed as an example in the previous chapter:

Farfalle, la collezione di gioielli da sposa disegnata in collaborazione con il *Wedding Planner* Enzo Miccio, è dedicata a tutte le spose che desiderano un gioiello ricercato ed originale, che le faccia sentire delle vere principesse.

The translation of the sentence contains a content inaccuracy that could result in vague information for the reader, namely the use of a proper name. Enzo Miccio is an Italian wedding planner known to most of the Italian population for his role as presenter in famous TV shows. Though such information that should be an incentive for users to buy his jewelry collection, it would be completely useless, let alone confusing, to non-Italian

users. For this reason, I decided to add extra information, such as the meaning of the non-translated name of the collection, and the explanation of who Enzo Miccio is. The result of the rephrasing is the following:

“Farfalle”, meaning butterflies, is a special wedding collection designed in collaboration with Enzo Miccio, the most famous Italian wedding planner. It’s dedicated to all the brides who wish to wear a refined and original jewel, to feel like real princesses.

The addition of extra information obviously implied an increase in sentence length, which in English, contrary to Italian, should be as short as possible. For this reason, structural editing was applied such as the addition of a full stop together with the creation of two separate sentences. Having resorted to structural editing means that though there is a sequence of proceeding steps, each step is not completely independent, but rather they are interwoven and each one is dependent on the others. Finally, Mossop suggest that after correcting factual, logical and mathematical errors the translator should point them out to the client, so that the source text errors can be corrected.

#### **4.1.3 Stylistic editing**

As the reader of a book can be a projection of the author’s imagination or a real known reader (Mossop 2007: 60), likewise web users can be both imagined or real life customers. The digital dataset offers plenty of research and more and more agencies are devoted to profiling the customer *persona*, which is a “fictitious, specific and concrete representation of target users” (Cooper 1999). Therefore, creating a tailored content is easier when knowing the users’ characteristics. Those suggested by Mossop refer to the readers of a document (Mossop, 2007: 60-64), but they could be extended to website users as well.

Knowing the user means to acknowledge her/his dimension of “homo communicator” (Snell-Hornby, 2006: 132), used to the new digital communication features such as emails, SMSs, WhatssApp, Social Media messaging apps and so forth. The digital has allowed people to perform many conversational activities simultaneously – such as phoning, answering emails at the computer and chatting in Whatsapp at the same time – but often without absorbing or ordering the endless snippets of information or the flood of images into a coherent message.

When writing or translating digital content, it must be borne in mind that screen texts are processed differently from printed ones, precisely because the new “*homo communicator*” does not always have the time to read all the digital content in which he is constantly immersed.

In the field of style assessment, where the user is the center of the design process, the issue of Web Usability is a key factor as it relates to user interaction and aims at improving their satisfaction and quality perception. The way the user processes information varies according to two modes (Jiménez-Crespo, 2013: 92). The first one is the reading mode, where the content is linearly processed and thus the rhetorical structure is composed of a series of moves and steps. On the other hand, in the navigation mode the readers do not follow the rhetorical structure, as they zoom out to the communicative purposes they are looking for. According to research by Nielsen (1997), reading of web pages slows down by 25% to 50% and, most importantly, the users scan the pages in order to find the information they are looking for or that might draw their attention instead of reading them (79% of the test users always scanned any new page they came across; while only 16% read word-by-word). Scanning on the web, according to another research by Nielsen, is dictated by users’ motivation, the goals they are trying to achieve, the layout of the page and formatting of text, and the page content. As a result, Web pages have to employ scannable texts, using highlighted keywords, meaningful sub-headings, bullet-point lists. This, for instance, is particularly important in the product description. As for formatting and paragraph length, each paragraph should only contain one idea; the inverted pyramid style should be used and the text should be shorter than conventional writing, i.e. half the word count (or less) than conventional writing. This implies that readers are not passive recipients of information, but rather actual users engaging and interacting with texts, and therefore also determining their structure.

It is not a coincidence that one of the main indicators of website success is a feature called ‘stickiness’, namely, the website’s ability to retain online users and prolong their duration of each stay. Longer visit durations can enhance user involvement and give them more time to complete purchase transactions. Furthermore, exposure to advertising is more likely with longer visit durations (Holsing et Al. 2012).

More and more research focuses on website usability and improving user experience as research show that one of the main reasons why users leave a web page is

the complexity of processing and finding information on the page. According to Nielsen, the first 10 seconds of the page visit are critical for users' decision to stay or leave (Nielsen 2011). Although, as Jiménez Crespo points out, translators are usually not in charge of such usability issues, they have to be aware that localized sites content should respect Grice's pragmatic maxims of quality, quantity, relation and manner. In other words, it should be clear, concise, efficient, relevant and truthful.

As Mossop observes, one of the key issues to consider when editing is the final users, their motivation, their familiarity with the subject – or knowledgeability, their education level and the purpose why they are reading the text (Mossop, 2007: 61). Thus, the tone used in a product description will be different from that of the “About Us” page, as in the first users expect to be provided with technical information conveyed in a professional way, whereas in the latter they expect a more original and personal content. With regards to motivation, e-commerce websites users might not always be motivated to read the text provided in certain pages – such as the “About Us” page – therefore the content must be enjoyable and attractive.

Another important factor pointed out by Mossop is education. Since the content of an e-commerce website has a mass readership, because online content can be accessed by anyone, the audience might include people with “relatively low literacy” (Mossop, 2007: 61). Hence, the text should be simple and easy to process, in order for all intended readers to be able to read it. The customer personas target by Alfio Lago e-commerce site are essentially women over 20 who love wearing jewellery and are always up-to-date on the latest trends, and men who are interested in watches, jewellery and may be looking for presents; therefore, it was decided that the style and tone to be used were friendly and with a simple vocabulary. Moreover, since the target audience is not supposed to be familiar with terms, these are confined to the product page, where whoever is interested can find all the detailed information. The parameter sub-language (Mossop, 2007: 125), which regards the use of field-specific terminology, is thus verified in this step of the process.

As for the descriptions of categories and the About Us page, they have to be captivating and recalling familiar concepts. One example of category description is the watch section description page:

Nella nostra gioielleria online ti proponiamo una selezione di orologi dei migliori brand dell'orologeria, da sempre il regalo ideale per compleanni e anniversari, cresime, comunioni e lauree. Se sei un amante dell'efficienza e dell'eleganza, scopri la tecnologia Eco-Drive di Citizen, o gli orologi di Bering, dal design minimal del Nord Europa. Per chi è a caccia delle ultime novità gli orologi del momento sono Cluse e DI Milano, un marchio sempre più richiesto in cui l'eleganza del design italiano si fonde con la qualità dei prodotti utilizzati. Come segnatempo di lusso ti proponiamo i noti marchi svizzeri Frederique Constant a Raymond Weil, una garanzia di qualità e precisione. [...]

The text contains important and familiar keywords such as 'orologi', 'elegance'; 'ultime novità', 'quality', without exceeding with the technical terms that can be found in the product page. Moreover, a friendly tone is used, by employing the personal pronoun 'tu', so the user is always at the centre of the message. Nevertheless, the Italian source text contains culturally-related words such as 'comunioni' and 'cresime', which can be of interest only of Catholic people and strongly influences our Italian culture and, in a collateral way, our purchasing habits. Therefore, I had to cancel these words and rephrase the sentence as follows:

Nella nostra gioielleria online ti proponiamo una selezione di orologi dei migliori brand dell'orologeria, da sempre il regalo ideale per compleanni e anniversari, lauree o altre importanti occasioni.

The final translation with DeepL, therefore, is:

In our online jewelry store we offer you a selection of watches from the best watch brands, always the ideal gift for birthdays and anniversaries, graduations or other important occasions.

In addition to the characteristics of the users, it is essential to understand what use they will make of the text, and the meaning intended by the author. Since the main goal of an e-commerce site is to sell products, the main function of text is that of convincing the reader. Nevertheless, the most common suggestion from business men and NLP experts is "to sell without selling", meaning that most of the times, if you want the so-called 'prospects' to buy and become 'customers' you have to engage them without forcing them to buy. An objection to this statement could be that when users visits an e-commerce site homepage, they are already conscious that their goal is to buy a specific product. However, sometimes people just browse in different website in order to get information, and only after they have got a satisfying amount of data, they decide to buy. In other cases, people might just want to get to know the profile of the company behind the

website. As a result, the text employed has an enormous value as it is a sort of business card of the seller.

In the field of stylistic editing, the parameter of ‘smoothness’ has to be considered, which regards the organization of sentence structure and connection between sentences. When using Machine Translation, the passages are pasted in the system, therefore the outcome is usually not smooth. As a result, stylistic intervention – recalling Bentivogli’s notion of “full post-editing” is required in order to create a more natural version.

An example of full post-editing with stylistic intervention is the transformation of this sentence:

Regalare o regalarsi un orologio Citizen significa apprezzare la tecnologia e salvaguardare l’ambiente, ma allo stesso tempo avere buon gusto. La qualità dei materiali si fonde infatti con il design elegante e sinuoso di questi orologi.

The translation by Google is:

Giving or receiving a Citizen watch means appreciating technology and protecting the environment, but at the same time having good taste. The quality of the materials blends with the elegant and sinuous design of these watches.

The sentence does not sound natural, therefore I carried out a stylistic intervention by moving the sentence “ma allo stesso avere buon gusto”, into the second sentence, making it longer but more relevant:

Treating yourself to a Citizen watch or giving it as a present means appreciating technology as well as protecting the environment. Moreover, purchasing a Citizen watch, where the elegant and sinuous design blends with the quality of the materials, is a sign of good taste and a choice of elegance and quality.

In matter of style, Fiederer and O’Brien conducted an interesting study that posed the question “how does the quality of the post-edited product compare with the quality of human translation?” (O’Brien et Al. 2009). According to what emerged from the XVI Machine Translation Summit in 2017 in the human comparative evaluation style is crucial when comparing MT systems from fundamentally different approaches.

Thus, conducting a comparative evaluation of quality for sentences produced by MT and subsequently post-edited and sentences that have been translated by humans, Fiederer and O’Brien investigated the assumption, claimed by many professionals in the

field of translation, that the product of machine translation combined with post-editing is inferior in quality to a human translated product. Fiederer and O'Brien point out that the existence of a range of different synonyms used to judge the translation output hampers the evaluation. (Fiederer and O'Brien, 2009: 55). For this reason, they chose three evaluation parameters in their methodology, i.e., 'clarity', 'accuracy' and 'style'. They considered clarity as a synonym for 'intelligibility', stating that it is the first parameter to consider since it is an "obvious and fundamental criterion for evaluating translation quality". It is concerned with the meaning of a text, rather than its wording, and it must not be confused with 'simplicity' or 'familiarity'. In order to assess this parameter, translators were asked how easily they could understand the translation. As for accuracy, the extent to which the meaning of the source language sentence is preserved in the translation, intended as synonymously to fidelity, translators were guided in their assessment with questions asking to what extent the translation contained the 'same' information as the source text.

Despite being considered important in the rating of human translation, in particular in literary domains, style rarely figures as an evaluation parameter in the rating of MT output. Nevertheless, in a study whose aim was to compare human translation quality with machine translation and post-editing quality, this was a fundamental parameter to be considered. The questions guiding the evaluation were: "is the language used appropriate for a software product user manual? Does it sound natural and idiomatic? Does it flow well?".

During the evaluation exercise, the researchers did not tell the evaluators of the involvement of MT, in order for them not to be negatively influenced. Indeed, as Fiederer and O'Brien point out, there are common misconceptions regarding MT output, according to which "MT does not work" (Schäler, 1998:153) and threatens the job of translators. The results show that evaluators found translators' and post-editors' output equally understandable. Secondly, evaluators deemed post-editors' outputs to be more accurate than those produced by translators. Hence, when quality is defined along the parameters of clarity and accuracy, the results of the research show that the MT post-edited quality is on a par, if not greater than, human translation. (Fiederer and O'Brien, 2009:68-69)

The explanation for these results might be that post-editors may have scored higher as they were potentially more focused on accurately reflecting ST meaning than

translators, who may have been more focused on the stylistic quality of the target text, for example.

Nevertheless, as mentioned above, style is the only category where, overall, translators scored higher than post-editors. This data shed light on the different approach adopted by post-editors and translators. While the first might have been more concerned with the criteria *clarity* and *accuracy*, the latter have shown to be focused on the *style* of the translation. This may be due to the fact that, according to some research, a translator will always “strive to disguise the fact that the text has been translated” (Senez 1998).

An important type of stylistic editing is the elimination of verbosity. Therefore, unnecessary words were removed as they were a cognitive obstacle to text processing, as in the example ‘oreficeria’, explained in the structural editing section. Another example might be found in the jewellery category description, where a sentence reads:

Se vuoi realizzare un gioiello personalizzato o hai un particolare design in mente, contattaci al nostro servizio clienti: il nostro laboratorio orafo potrà dare forma ai tuoi desideri!

The translation produced by DeepL is:

If you want to create a personalized jewel or have a particular design in mind, contact us at our customer service: our goldsmith atelier will give shape to your desires!

The words “customized jewel” and “particular design” express the same concept of customization, therefore it might sound redundant and overload the reader with useless information. For this reason, I changed the sentence using a friendlier tone and rephrasing the assertion into a question:

Are you wishing for a customized jewel with a particular design? Contact us at our customer service: our goldsmith workshop will be happy to give shape to your ideas!

As Mossop points out, the debate regarding correct or proper usage is still ongoing among scholars. What is certain is that prescriptions do not always reflect reality, and sometimes they can hinder communication, as in the case of ‘hypercorrection’ phenomena (Mossop, 2007: 52). These are errors caused by linguistic interferences and manifest themselves with the hyper generalization of linguistic behaviours in contexts where they are not appropriate (Santipolo 2006: 143). Therefore, translators should be concerned with

communicative effectiveness rather than conservative correctness, since more and more people are writing and reading in English as second language, thus being less sensitive to a tradition of correctness.

#### 4.1.4 Copyediting

Copyediting is a line-by-line, micro-level work that requires focusing on small details. It deals with the correction of spelling errors, as they distract and slow down the reading process (Mossop, 2007: 39). Moreover, the sense of ‘foreignness’ mentioned in the first chapter produces a very bad impression, which may result in the loss of reliability and, consequently, sales.

Such ‘foreignness’, which relates to the “look and feel” conferred to the website by its content, is strongly influenced by the errors in the texts, and there are many instances of it throughout the web, to the extent that many books, blogs and Facebook pages have been dedicated to spotting and mocking them.

The following image displays a screenshot from the confirmation of an order I recently placed at an international e-commerce website selling clothes, which I will briefly describe for the purpose of expounding upon the notion of ‘foreignness’.

Caro Laura Tomasello,

Grazie per il suo ordine, speriamo che lei ha un buon tempo di shopping con noi. Il suo numero d'ordine è:  
APA16061

Il suo ordine è ora in fase di processo, un'e-mail di conferma di spedizione sarà inviato quando il suo ordine è stato spedito. E noi consegniamo la sua merce a:

*Figure 34: Screenshot of a confirmation order email*

It can be observed that the email contains basic grammar mistakes. The sentence “speriamo che lei ha un buon tempo di shopping con noi” is a literal translation from the

English “we hope you have a good shopping time with us”; furthermore, the noun ‘confirmation’ has been mistranslated into ‘confermazione’, rather than ‘conferma’. In addition, “il suo ordine” is repeated four times in six sentences, i.e. it is redundant. Finally, the use of the male adjective ‘caro’ instead of ‘cara’ shows lack of consideration for the user who had previously registered and taken time to fill in the form where the parameter of gender was required.

This example suggests the results of poor investment in localization, as the translation into Italian sounds artificial and does not convey a sense of trust in the user. In fact, after reading the mail, I decided to check the feedback from the customers of this e-commerce website (which I should have done before purchasing) and, among much negative feedback, I read that the clothes were made with poor quality materials and the customer care was not able to cope with the users’ requests. As a result, I cancelled my order and asked for a refund. Undoubtedly, the complexity of the localization process requires time and resources, therefore, as already discussed, not many companies have enough resources to afford it.

I noticed some mistakes even when browsing through the websites of competitors from the same category of [www.alfiolago.com](http://www.alfiolago.com), who have been leader in the Italian market for many years. For instance, the Italian sentence “Alla confezione regalo ci pensiamo noi” was translated into “The gift we finish”; or “Una finitura che non si ossida” into “A finish that does not hesitate”. Such mistakes, which are similar to those analyzed in the previous chapter, suggest that the translation process has been carried out by a machine and was not post-edited. Certainly, post-editing MT requires resources in terms of time and money, therefore the majority of companies needing to sell abroad do not have enough time to invest in improving machine output.

Jiménez-Crespo (2013: 117) provides several different definitions of errors. An absolute error is considered as such regardless of situation, context of text type; while inadequacies or functionalist errors originate from the brief or source text, therefore pre-editing is required and should be pointed out to the client.

Errors at the macrotextual levels, such as using different terms for the same concept, go against the notion of predictability and are one of the main issues in localized websites. For this reason, once I decided to translate ‘contattaci’ with ‘contact us’ instead of “get in touch with us”, or “email or phone us”, I had to be consistent and rely to that translation

throughout the website. Another example of error at the macrotextual level is the literal translation of advertising texts that might be expressed differently from one culture to another.

Finally, translation mistakes are random errors committed by translators due to the cognitive interference of the translation. They are usually referred to as random or ‘stupid’ errors, as they are normally immediately recognized by the translator. Nevertheless, translators might not always notice them and, sometimes, they can even make errors as a result of a cognitive bias. In this regard, Picinini and Ueffing (2017) conducted interesting research to investigate whether the MT system influences the human translator, thereby introducing ‘bias’ and potentially leading to errors in the post-editing. By analyzing how often translators accepted an incorrect suggestion from the MT system and determining different types of bias errors, their results shed light on the fact that the post-editing of MT is influenced by a significant bias. Moreover, they found patterns that cause MT errors that should be considered for improvement of post-editing. Interestingly, the research demonstrated also that Neural MT is likely to reduce bias errors as the original MT error is eliminated by its output, which is far better than that of SMT. The researchers claim that their findings cannot be generalized to all cases, nevertheless they prove the existence of bias and can be a great contribution for improving post-editing. This research proved very useful in the post-editing process of this project as it served as a suggestion to spot and avoid bias errors.

As Jimenez-Crespo observes, the seriousness of an error depends on the extent to which it infringes the effectiveness or usability of the target text. For this reason, an error in the navigation menu or interactional sections such as payment methods or “contact us” pages have a different impact than errors in other pages, such as the “About us” page (Jiménez-Crespo, 2013: 120).

As discussed in Chapter 3, despite being an aid to translators, MT often creates serious syntax errors, such as missing words, or unwanted extra words, false present-tense verb agreement, and other common errors that regard punctuation. In carrying out my translation project, I created the following taxonomy of the most recurrent errors produced by statistical MT:

Table 1: Taxonomy of the most recurrent errors produced by statistical MT

<b>Error</b>	<b>Description</b>	<b>Source Text</b>	<b>MT output</b>	<b>Correct Version</b>
<b>Do Not Translate terms</b>	Brands and other terms that should not be translated (proper names) are a cause of errors for MT as the engine has to decide if the term is a brand or a common word.	Alfio Lago Comete Gioielli Ti Sento Milano	Alfio Lake Like you Jewels I hear you Milan	Alfio Lago Comete Gioielli Ti Sento Milano
<b>Mistranslation</b>	They relate to issues where the translation is wrong but the cause can't be easily identified.	portachiavi e ce ne siamo innamorati	key board and us by it we are fallen in love	key chain we fell in love with it
<b>Polysemy</b>	Coexistence of many possible meanings for a word or phrase.	Firme di gioielleria gemelli per camicia orologio incisioni	Jewellery signatures binocular for shirts clock recordings	Jewellery brands Cufflinks watch engravings

<b>Multiword expressions (MWE)</b>	A sequence of words has a completely different meaning than the individual words.	disponibili a magazzino  senza tempo	available to warehouse  without time	available in stock  timeless
<b>Terminology</b>	This cause of errors appears when the MT does not know the proper terminology for a certain subject matter.	segnatempo  arte vetraria	segatempo  vetraria art	timepiece  art glass
<b>Part of Speech (POS)</b>	The MT translates a word using the wrong POS for it.	esposte nei più importanti musei  disegnati dall'artista  che (relative pronoun)  Se desideri riparare  reso	exposed in the more important museums  designed from the artist  then  If desires to repair  made	exhibited in the most important museums  designed by the artist  which/who  If you wish to repair  return
<b>Untranslated words</b>	Failed word translation. These issue may be linked.	arte vetraria  segnatempo	vetraria art  segnatempo	glass art  timepiece

	to these words being out of vocabulary.			
<b>Use of inadequate prepositions</b>	Significant changes of meaning can be caused by a preposition. (ex: collection from bride / for bride).	brand italiano di orologi da uomo e donna  collezione da uomo  orologi al quarzo	Italian brand of clocks from man and woman  collection from men  clocks to the quartz	Italian brand of watches for men and women  collection for men/men's collection  quartz watches
<b>Word order</b>	Inversion of adjectives and nouns, or other type of errors in the word order.	le lavorazioni sapienti  che si riflettono nei nomi delle loro opere  simbolo religioso  la migliore tradizione Made in Italy	the workings sages  than works are reflected in the names of theirs  symbol religious  best Made tradition in Italy	the skillful processing  which are reflected in the names of their works.  religious symbol  the finest Made in Italy tradition

<b>Verb tense</b>	Use of a verb tense instead of another (e.g., past participle instead of imperative).	Sciacquate e asciugate per bene.  I prodotti personalizzati non potranno essere restituiti	Rinsed and dried properly.  personalized produced ones could not be given back	Rinse and dry properly.  Customized products cannot be returned
<b>Unidiomatic language</b> (Mossop, 2007: 21)	Odd word combinations or sentence structures calqued from the source text.	riserva di carica  fondo serrato a vite  se non diversamente espresso	reserve of charge  Locked bottom to lives.  if not various expressed	power charge  Screw-down back  unless otherwise stated

As the table shows, there are many different types of mistakes produced by the SMT engine. Among the most interesting to note is the use of the wrong part of speech (POS). For instance, in the clause “Se desideri riparare il tuo gioiello”, the SMT engine considered ‘desideri’ as a noun, therefore it translated it with ‘wishes’ and not as a second person present tense verb ‘wish’.

Another very recurrent error is the mistranslation of the Italian prepositions ‘da’ and ‘a’. The preposition ‘da’, for instance, can have several meanings: preposition of direction (to be translated with ‘to’), origin (to be translated with ‘from’), agency (to be translated with ‘by’), time duration (to be translated with ‘for’ or ‘since’), or purpose (to be translated with ‘for’) and so forth. In many instances, the SMT engine, not recognizing

the context, translated the preposition having final meaning with ‘from’ instead of ‘for’, as in the case of the translation ‘collection from women’ instead of ‘collection for women’ or, as better suggested by NMT engines ‘women collection’. Such mistakes that are regularly found when analysing the output of SMT (Anastasiou et Al., 2011) are caused by a generation algorithm that simply suggests the generation of the preposition ‘from’ where the Italian ST contains the particle ‘da’. Another example that shows how the algorithm works can be found in the sentence: “un must have sia per l’uomo che per la donna”, which I translated by the SMT with “a must have is for the man who for the woman”. Here, the Italian conjunction ‘che’ is not translated into the correlative “both...and” with its additive meaning, because the algorithm registers that, statistically, the word ‘che’ after a noun has to be translated with the relative pronouns “who/which”. The correct translation is “a must have for both men and women”.

The use of the wrong verb tense also appears among the most frequent errors. One instance is to be found in the words “Sciacquate e asciugate per bene”, extracted from a blog page in [alfiolago.com](http://alfiolago.com). These imperative verbs were considered as past participles rather than imperatives, being therefore translated as “rinsed and dried properly” instead of “rinse and dry properly”.

#### **4.1.5 Consistency Check**

Mossop observes that consistency is not always necessary to achieve, depending on the purpose of the text (Mossop, 2007: 89). If it is a legal document, then it is essential for it to be consistent with the source, if it is informative, it is not essential. Therefore, it is always necessary to understand which features of the text need to be consistent, whether terminology, whether page layout, whether manner of addressing the reader. In an e-commerce website, consistency is imperative with product names and feature descriptions.

As Mossop points out, the effort devoted to consistency should never take priority over accuracy, meaning that errors in the source text should not be reproduced just for the sake of accuracy (Mossop, 2007: 88). Accuracy is a parameter that ensures that the meaning of the source text is not altered, and that the translation does not mislead the user. Thus, the editor must ensure that the original message is preserved in the translation

as well. Inaccuracy usually arises when the translator does not understand the content of the text. For this reason, the translator should feel free to ask the client what was meant in the text. Moreover, this proves the importance of revision by a third party that is not the translator/editor him/herself. Hence, consistency must be pursued when its lack creates a communication barrier. However, as already discussed with Hofstede's dimension of "uncertainty avoidance", consistency is vital in e-commerce websites since users expect to find familiar features. Product pages, for instance, cannot contain different referents to express the same concept, otherwise the user would be confused and overloaded with information.

Furthermore, translators are required to stick to common website conventions such as the title of the "About Us" page, or the "Contact Us" form. A 2002 report by Nielsen and Tahir shows that, despite the possible alternatives like "get in touch with us", "how to reach us" or "call or email us", 89% of commercial website in English use "contact us". In this respect, Jiménez-Crespo claims that, nevertheless, any translator should be acquainted with all the possible variants of a given feature (Jiménez-Crespo 2013: 84). The reasons mentioned above suggest the importance to decide consistency ahead of time, with the creation of a proper terminology database to be used in translation memories, features that were expanded upon in the previous chapter. Mossop, moreover, observes that among many computer aids to checking and editing, spell checkers are useful tools in order to detect spelling mistakes that can be easily missed by the eye. This can be used together with the "Find & Replace" function, which allows translators to find the mistake and replace it with the correct term.

This chapter has tried to shed light on the complexity of the editing process, which is still necessary in order to make MT output publishable for readers and enjoyable for website users. Such complexity represents a challenge to translators, as their role has changed – and is constantly changing – due to the increasing efficiency of MT. Most of the MT errors that nowadays translators are asked to fix mainly relate to the output of SMT. As explained in the previous chapter, NMT tools provide an output that outperforms that of SMT in terms of quality and proximity to golden standards, therefore the most frustrating part of the post-editing job relating to the repetitive correction of the same trivial mistakes – such as those listed in the taxonomy above – is bound to change allowing translators to deal with more challenging tasks. As explained during the EU

Conference in Brussels in November 2018 and as observed by researchers (R. Fiederer and S. O'Brien, 2009), (Jiménez-Crespo, 2013), (Bentivogli et Al., 2016), (Agrawal et. Al, 2018) (Senellart, 2018) the translator's job is experiencing a shift to an even more intellectualized level, where mechanic tasks will be performed by machines, leaving space for human creativity. In order to explain what is meant by this, I will briefly describe the human involvement during the training process of a neural engine, in particular that of Neural Google Translate, since Google is among the first large-scale implementer of NMT in a production environment (CSA Research 2018).

## **4.2 Training of Google Auto ML Translation**

Google AutoML Natural Language is based on machine learning, which implies the use of data to train algorithms to achieve a desired outcome. As discussed in Chapter 2, there are many different subcategories of machine learning, all of which solve different problems and work within different constraints, such as image recognition, natural language processing, video intelligence and so forth. Given that the specifics of the algorithm and training methods change based on the use case, Auto ML Translation enables the user to perform supervised learning, which involves training a computer to recognize patterns from labeled data. By using supervised learning, a custom model can be trained to recognize the content in texts.

In order to train a custom model with AutoML Natural Language, the translator is required to supply labeled examples of the input to be classified, and the desired output required from the ML systems. The procedure to create a dataset, which serves as the input for training a model, is straightforward: after choosing the name of the dataset, the language pair must be selected, namely the source language and the target language of the translation. As suggested in the Auto ML Translation documentation, the more sentence pairs, the better. Post (2018), a research scientist at Johns Hopkins University observed that, whereas in the statistical MT era the maximum was “more data is better data”, with the shift into the new Neural MT paradigm this is no longer the case, as “cleaner data is better data”. Consequently, translators play a vital role in ensuring the quality of the input provided to neural engines, thus, human expertise will always be required.

AutoML Translation trains custom models using matching pairs of sentences in the source and target languages. It treats each sentence pair as an independent training item, without assuming any correlation between separate pairs. Preparing the training data involves the greatest part of the work, as the translator has to carefully select words, phrases, idioms matching them with the output that she/he wants to obtain. The supported file formats are tsv. and tmx., and more files can be added to train the engine. The sentence pairs provided are used by AutoML to train, validate, and test the custom model. In order to create a custom translation model as a test to train the machine meeting the linguistic requirements of the website [www.alfiolago.com](http://www.alfiolago.com), I prepared a spreadsheet with 110 sentence pairs. The pairs contained words extracted from the front-end of the website such as ‘contact’, ‘search’, as well as from the product pages, the category descriptions, the “about us” page and so forth. The following figure shows part of the list:

**Training 1 - Foglio1 (1).tsv**

Showing first 20 of 110 pairs

Italian	English
chiusura a farfallina	butterfly closure
chisura a moschettone	lobster clasp closure
pietra dura naturale	natural hard stone
filo elastico trasparente	transparent elastic thread
zirconi	zircons
madreperla	mother of pearl
chiusura ad uncino	hook closure
contrarié	contrarié
chiusura a pressione e scatto	snap clasp
placcatura rodio	rhodium plating
bracciale in maglia milanese	milanese mesh watch strap
indici	index
solo tempo	time-only
impermeabile	water-resistant
riserva di carica	power reserve
fondo serrato a vite	screw-down bottom
lancette fluorescenti	fluorescent hands.
riserva di carica di 180 giorni	180-day power reserve
ghiera	bezel
indici	markers

*Figure 35: Screenshot of the datasheet containing the pair sentences to train the neural engine*

The majority of the 110 pairs prepared in order to test the machine learning process contain technical terms and polysemous words that can cause translation mistakes in the MT output. Once the dataset is uploaded in csv. or tsv. format, a confirmation email is sent to notice the user that the operation has been successfully carried out. Once the dataset has been reviewed, the training can start by clicking on the ‘train’ tab. A “Train New Model” dialog box appears, allowing to choose a model on which to base the new model. When there are no other models, AutoML Translation bases the new custom models by default on Google's Neural Machine Translation (NMT) model.

## Train new model

### Base model

Google NMT

### Data summary

88 sentence pairs for training

You will be emailed when training completes (typically 3 hours). See the [Pricing guide](#) [🔗](#) for details about training time and cost.

## Your model is ready to be trained

**Source language** Italian

**Target language** English

**Training pairs** 88

**Validation pairs** 11

**Testing pairs** 11

START TRAINING

*Figure 36: Preparation of the training procedure in Google Auto ML Translation*

As shown in the image, the automatic option – recommended if the dataset contains less than 100,000 sentence pairs – selects 10% of the sentence pairs for validation and 10% for testing. After training a model, AutoML Translation uses items from the validation and test sets to evaluate the quality and accuracy of the new model. AutoML Translation expresses the model quality using its BLEU score, as explained in Chapter 2. This score indicates how similar the candidate text is to the reference texts, with values closer to one representing more similar texts.

Once the training starts, it can take several hours to complete, depending on the complexity of the dataset. The cost of AutoML Translation is calculated in terms of how many characters are sent for translation; which is free up one million characters, whereas the cost for training a model is \$76.00 per hour. The training phase with the 110 sentence pairs uploaded lasted 1,82 hour and I was notified with an email once the training was completed. The new model can be tested by clicking on the ‘predict’ tab and entering the text in the source language.

When I tested the new model, I discovered that, even though the two versions mostly correspond, the machine learning process was essential to disambiguate some words or provide a more specific term. In the case of the already mentioned polysemous word ‘fede’, for instance, the Google model translated the word into ‘faith’, whereas the custom model trained with the data I had previously prepared translated it correctly, since I had inserted the pair ‘fede – wedding ring’.

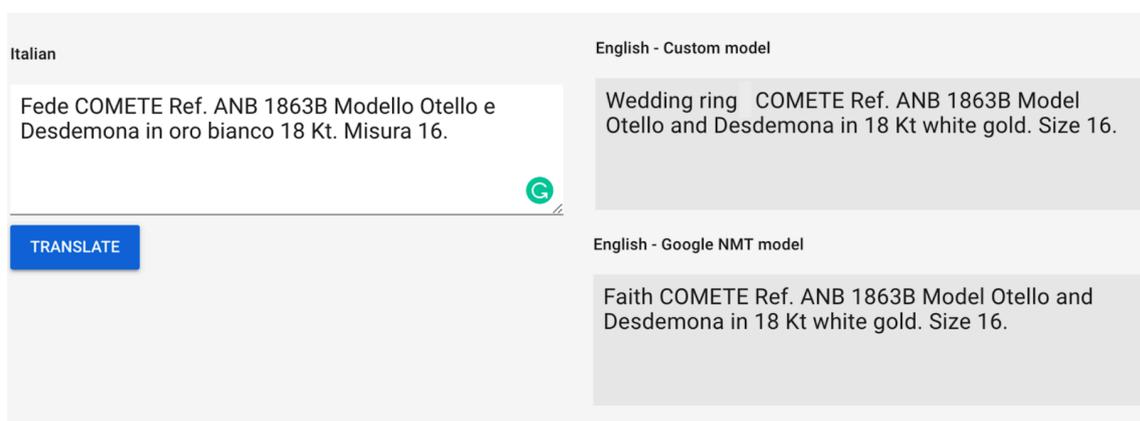


Figure 37: Comparison of the custom model and Google NMT model

Other examples of inaccuracies of the Google model that were corrected in the custom model can be listed, such as the watch feature ‘solo tempo’, translated into ‘only time’ by the Google model, whereas the correct translation was ‘time-only’; or ‘paesina’ – a kind of limestone or marble – which was mistranslated into ‘village’ by Google model whereas the custom one correctly translated it into ‘ruin marble’.

In some cases, however, the Google model was more accurate than the custom one. In the translation of “chiusura a doppio deployante”, for example, where I translated with “double deployant closure”, the Google model suggested “double folding clasp”, which is a more accurate translation. In other cases, even if the Google model did not provide the same translation of the custom one, both of them were acceptable, as in the case of “chiusura a moschettone”, which can be translated both into “lobster clasp closure” as suggested by my model, and “snap hook closure”, as suggested by Google NMT.

Furthermore, where I erroneously set the sentence pair “2 anni di garanzia ufficiale – 2 years of official guarantee”, the Google model translated correctly into “2-year official warranty.” In this case, the machine provided a more accurate output than the custom model, since I was biased by interference with my mother tongue and I inadvertently transferred the Italian structure into the output, which is called negative linguistic transfer (Santipolo 2006: 167). This fact proves that not only do NMT engines produce a high-quality output, but they can also allow translators to spot mistakes due to fatigue, bias or other causes.

The training, testing and comparing process lead to the conclusion that the output provided by the neural engine is accurate and clearly outperforms that of SMT, even though it requires post-editing with regard to fluency, word positioning and technical terms. Machine learning plays an important role to this extent, since the possibility of creating custom models allows to set certain parameters – such as the translation of certain technical words – in order to obtain the desired outcome without needing further post-editing. The overall high quality of the Google NMT model demonstrates the huge improvements in NMT, which can be exploited as tool to relieve translators from the massive amount of content to translate in limited time but most of all, from mechanical and frustrating tasks such as correcting mistakes that can be avoided with the use of machine learning.

It can be concluded that, if a precise output is to be obtained, the skills and expertise of translators are, and will continue to be, necessary in order to prepare an accurate data set to train the machine. Hence, the combination of the human effort applied in the preparation of the data to feed the system together with the deep learning capacity of the newest neural machines can represent a great help to speed up the translation of repetitive texts, such as product descriptions in e-commerce websites.

To sum up, this chapter has demonstrated that, efficient as they are, even the newest state-of-the-art NMT tools require humans to be programmed, and, most importantly, to be trained and to have their output edited. For this reason, translators should not be afraid or feel frustrated towards the changes brought by MT, as humans will always be a necessary link in the translation chain. With reference to this, the next and final chapter will shed light on the new skills that translators will have to develop in order to thrive in the new AI era.



## **CHAPTER 5: The role of the human translator in a future dominated by machines**

In the “informational era” we are living, new questions begin to arise, such as whether in the era of globalization the figure of the translator does not need to be fundamentally reconfigured. It is clear that the role of the translator is no longer that of taking texts from one source language and transforming it into another, but it has been transformed because of the increasing presence of MT in the business market. As was shown in the previous chapters, the new developments in technologies with AI, in particular for the creation and improvement of NMT, are a necessary step to meet the growing demand of the market, be it in translation or in other fields. It would be namely unusual if translation as a profession were to be exempt from the profound alterations brought about by these changes, in fact, as Cronin points out, “it is neither possible nor desirable to treat translation as a *sui generis* activity in isolation from the industrial, technological and economic history of societies” (Cronin, 2003: 113).

Vintaloro, expressing this concern about the improvement of neural MT, observes that more and more publishers will start using new MT tools, such as Google Translate, thus, translations will cost less, there will inevitably be many more translations on the market and readers will benefit from greater editorial variety. Before Neural MT, translating a novel could take several months, but now, thanks to AI, it will take few weeks. Accordingly, translators will be able to handle more translations at the same time. As a result, as Vintaloro claims, it will be inevitable that many less specialized translators will lose their jobs, and many translation courses will close (Vintaloro 2018).

This view may sound worrisome to many, who might feel threatened in their position in the society. In his paper forecasting the rise of synchronous, automated translation systems (SATS), Lehman-Wilzig provides what could be seen as an alarming forecast for translators, claiming that the “most obvious economic consequence will be *the virtual disappearance of the translation profession*. First textual translation will disappear, and ultimately oral translators” (Lehman-Wilzig 2000: 484 [his emphasis]). As Cronin points out, the nervousness surrounding the advent of increasing automation in translation and the proliferation of free, Web-based, MT translation services such as those analyzed in the previous chapters is not only caused by a fear of

poor standards and low quality. It is mostly related to what is perceived as a “radical undermining of the status of the human translator as mediator”. (Cronin, 2003: 65)

Moreover, as pointed out in a report by the European Commission, one of the aspects connected to the digital revolution that already in 2012 was worrying translators is crowdsourcing. The concerns regard the fear of losing their source of income if translations are produced for free by amateurs. Moreover, many professionals blame crowdsourcing for being a weapon in the hands of companies to exploit and make profit from free labour. Finally, the issue of quality is regularly raised, because the lack of specific qualifications and expertise of non-professionals raises the issue of quality assurance and responsibility for the production of inappropriate content (European Commission 2012: 36-37).

The supporters of crowdsourcing insist that, even if it continues to grow, it will never be a threat to highly qualified professional translators. On the contrary, they claim that, along with the improvement of MT, it will allow translators to compensate the disproportion between resources and content to be translated at a time when the request of translations hugely exceeds the working capacity of human translators. They add, moreover, that the fields where crowdsourcing can be applied and those that are and will remain the prerogative of professionals are quite distinct, and overlaps are limited. Thus, the role of qualified professionals will always be a must in fields where confidentiality and accountability are required (European Commission, 2012: 37). The report of the European Commission seems to highlight the benefits brought by crowdsourcing, which will give importance to translators by freeing them from their “dusty offices” as well as enhancing their role of promoters of improvement in the society:

By promoting linguistic diversity on the Internet, notably giving access to information in languages usually disregarded for lack of economic impact, crowdsourcing favours inclusion and opens the Web to ethnic and social groups which would otherwise be excluded, thus fostering its democratic character. Secondly, we can expect – and hope – that crowdsourcing, with communities gathering around a common interest or passion, will help dispel the common perception of translation as an invisible and rather dull activity we become aware of only where there is a problem, a chore carried out in dusty offices by isolated individuals always on the verge of losing contact with the world and their fellow individuals. The collaborative way of working highlights that, also in translation, constant sharing of ideas and experiences is essential to obtaining good results. Crowdsourcing can help raise awareness about the role of translation for the success of any initiative aimed at a large public. It can contribute to discard the perception that it is merely a sterile and repetitive task with no creativity involved, unclear purposes and doubtful usefulness, and show on the contrary that it is an essential tool to foster democracy and inclusion, offers great reward, helps break isolation and enables integration into a motivated and well-organised community, favouring contacts and

exchanges with other people involved in the same activity and sharing the same interests and goals. (European Commission, 2012:36-37)

Hence, in a worrisome scenario where translators fear that their expertise will be outdone by machines and non-professionals since they perceive innovative options like crowdsourcing and the constant improvement of MT tools as a threat, there seems to be a glimmer of hope. It is true that the language sector feels an existential angst caused by artificial intelligence, broadening request for content and changing client requirements, nevertheless, claims relating to the demise of the translation profession are regularly confounded by statistics. There are now more translators working than at any other period in human history, and there is a forecast of translation volumes increasing by 67% over the next 3 years (Systran 2018). In this regard, a research conducted on June 2018 by CSA sheds lights on the language services revenue.

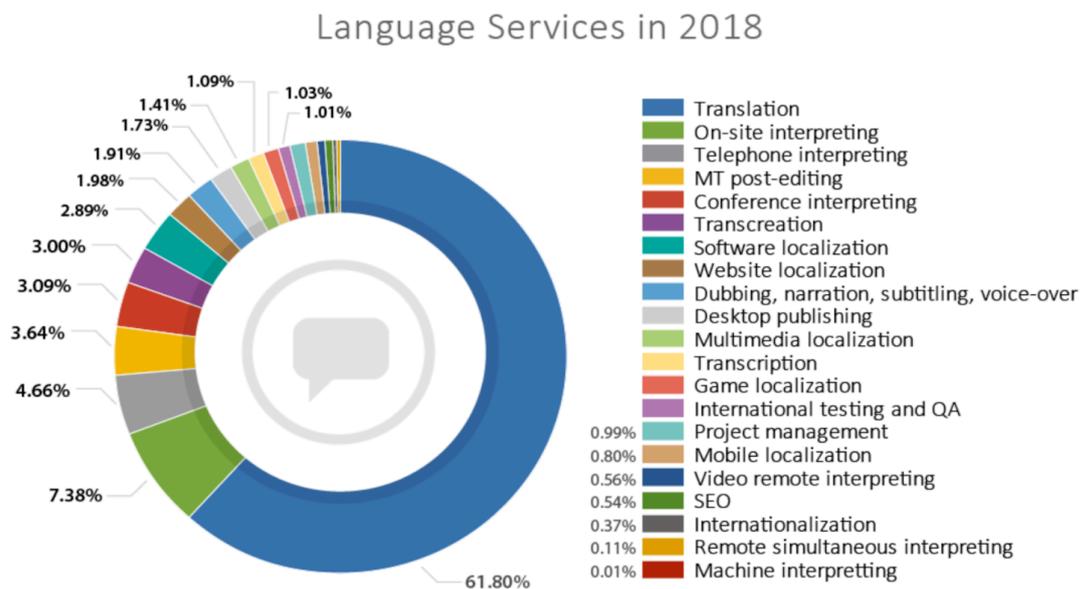


Figure 38: Distribution of the language services revenue in 2018. Source: Common Sense Advisory, Inc, 2018.

As the image shows, translation is the backbone of the language services sector and continues as the dominant service, accounting in its various forms for more than 60% of the industry’s turnover. Nevertheless, services like MT post-editing have been appearing on more and more LSP offerings and, according to the research, “it is no surprise that the prospect of better machine translation terrifies some suppliers” (CSA 2018).

However, where many translators consider the improvement of AI as a threat, it should be welcomed as a challenge: indeed, by understanding that there is an urgent need to change the paradigm in work and training at all levels this change will not be a catastrophe. All things considered, humanity has been facing technological changes since the dawn of time. Just as the innovations during the industrial era allowed machines to perform a variety of physical tasks that were formerly done manually, so is the advent of programmable machines making the automation of repetitive mental tasks possible. In this way, as Cronin observes, the new technological innovations have caused a shift from the “externalization of the hand to the externalization of the brain” (Bourg, 1996: 185 cited in Cronin, 2003: 113).

After few months, Vintaloro seemed to change perspective and envision a possible future where MT can improve translators’ lives. In spring 2018, he discussed the advantages brought by MT to translators in the Italian translation magazine *Tradurre*. As he observes, these advantages imply that translators will only have to post-edit and not translate from scratch and then revise the translation again, leading to considerable time saving and, consequently, less mental and visual fatigue related with the time spent on translations. In some text types, the automated output will be more accurate, therefore saving even more time and effort. Therefore, what is perceived as a threat by many hides, in fact, great opportunities, as work is becoming more and more intellectualized thus giving room to human creativity.

One of the effects of the ‘cerebrofacture’ cited by Cronin, which implies that the role of the worker consists in the manipulation of symbols rather than objects (Cronin, 2003: 113), has namely been the mechanization of certain intellectual tasks. This has been shown with the comparison of statistical versus neural MT: if the previous caused the translator to repetitively and mechanically correct the MT errors without any creative contribution, the neural MT does not require a repetitive correction, as it is thanks to mistakes that it is trained and its output can be improved. As Way and Hearne observe “If [linguists and translators] are to make an impact in the field of MT, they need to know how their input is used by the systems”. This involvement of translators and linguists is crucial now that NMT is not only challenging the dominant position of SMT, but also establishing itself as the new paradigm. From this view, the contribution of man emerges as vital. As observed by Pouliquen, senior engineer at WIPO and responsible for NMT,

there are two key ingredients for a successful NMT. The first one is data, whose preparation and ‘cleaning’ is highly important and can only be performed by humans. The second ingredient is people. It is their intelligence that makes it possible to understand what to do with data and how to manipulate an algorithm if it does not produce the desired output. Human translators will therefore shift their role into teachers and trainers of neural machines, as they will be given the task to supervise and spot mistakes and correct them, which is certainly more challenging and undoubtedly less frustrating than correcting mistakes in a mechanical and repetitive way. Indeed, Google Translate, DeepL, and their peers will:

free translators from the ungrateful work that even a machine can do and will leave the creative sector in the hands of those who will have the expertise in how to build an encyclopedia of knowledge that will allow managing any project, a wide range of competence and professionalism that no machine can imitate and no customer can question. (Vintaloro 2018)

Consequently, MT tools assist rather than subjugate translators, therefore they can deepen and define rather than remove our humanity (Cronin, 2003: 117).

The question how does AI affect translation and the future of the language industry was the focus the roundtable discussion at the “Translating Europe Forum” held on 8-9 November 2018 at the European Commission in Brussels. Since what emerged from the discussion, there is a wide consensus that AI can make important contributions to technical progress in society, by helping shape business and generally making people’s lives easier. As previously discussed, AI will be one of the factors contributing to the economic growth (McKinsey 2018).

Even if AI and automation will bring benefits to business and the economy, major disruptions to work are to be expected, and the work of translators will not be an exception. Luckin proposes to think about AI not as a substitute for human intelligence, but rather as the study of intelligence, since unless we understand what intelligence is, we will not be able to build a technology that can behave intelligently. Stating that AI is incredibly sophisticated and useful, she adds that “it is no way near the sophistication of human Intelligence”. (Luckin 2018)

However, since the human brain does not possess the computing power and memory of a machine, scientists are working to effective algorithms that can learn very quickly and very efficiently. According to the developers, translators will not be required

to know how to code, nevertheless, as suggested by Specia (2018) at the same conference, they will need to understand how the technology works and what to expect from it. With a very concrete simile, the professor compares AI to children's intelligence. Machines need to learn in the same way a child learns to write, by trying again and again, which in science is known as the process of trial-and-error. In the same way as a child is given a particularly biased set of feedback about the letters that he is forming that will impact on how s/he learns, so are machines matched with a huge amount of information that allows them to learn about specific things.

For this reason, the notion of the job of translators being fully replaced by machines is considerably less plausible than the emergence of translators as "translational cyborgs" where the levels of interaction between humans and machines becomes "deeper and more extensive, with the strengths of each relating to the other in an optimal and mutually complementary fashion" (Cronin, 2003: 116). In such a view where translators are more likely to creatively engage with MT systems, it is inevitable that they will have to develop new skills, as their role is being completely revolutionized.

As Jiménez-Crespo points out, translation competence is composed of several interrelated sub-competences, where at least three basic sub-competences play an essential role: communicative and cultural competence, strategic-transfer or macrostrategic competence and tools and research competence (Jiménez-Crespo, 2013: 168). The last one is an essential element in all modern translation competence models, and refers to a wide list of technological competencies such as knowledge of TM tools, terminology management tools, basic knowledge of markup languages such as HTML, the ability to use the appropriate Internet resources to solve specific problems and so forth (Jiménez-Crespo 2013: 176). For a few years now, writing has meant interacting with a variety of digital technologies and memories (dictionaries, glossaries, databases, corpora, search engines, etc.). Since the main effect of the technological revolution has been the enormous increase in our ability to store data, an increasingly conspicuous part of the translator's activity consists in searching for suitable sources in order to create a User Dictionary and a Translation Memory.

Moreover, as already demonstrated, new technological and analytical skills will be required to work with NMT. As Way observes, translators need to look at the translations and validate them, and tell the developers what the system is correctly accomplishing and

what sorts of mistakes it is making so that they can fix them in the next iteration. System developers need human translations to feed the systems with proper data, since this human input is exactly what allows the system to learn patterns and to start producing good translations, as was previously shown by means of the training process of Google NMT. Thus, human translations are used as reference translations to measure the quality of neural engines. It can therefore be assumed that human translators will continue to play a lot of vital roles in the whole translation process.

Referring to the models proposed by the PACTE research group, many other sub-competences can be listed. Pragmatic, socio-linguistic, lexical-grammatical and textual knowledge include knowledge about the functions of language, communicative situation and sociocultural norms, and it is particularly important, for instance, when translating advertisement texts. No less important is the extralinguistic sub-competence, which includes both accumulated knowledge about the world and about the translator's field of specialization.

In sum, handling web-based texts is nowadays a core competence for all translators: undoubtedly, they need to have a high level of technological competence to effectively train AI, along with a high level of writing and language skills in order to be able to assess the difficulties and different qualities of texts. Nevertheless, as Jiménez-Crespo observes, while 20% of the translation competence is normally represented by declarative knowledge, the 80% is characterized by operative or procedural knowledge (Jiménez-Crespo, 2013: 183), which is defined by PACTE as the ability of

[...] solving problems and guaranteeing the efficiency of the process. It intervenes by planning the process in relation to the translation process, evaluating the process and partial results obtained, activating the different sub-competencies and compensating for deficiencies, identifying translation problems and applying procedures to solve them. (PACTE, 2005)

Therefore, strategic subcompetence, which mostly entails operative knowledge, requires not only the ability to solve the most recurrent problems in the translation tasks, but also the ability to cope with new unpredictable problems that may arise by applying specific strategies and solutions based on situation, context, client, commission and so forth (Jiménez-Crespo, 2013: 179).

The use of MT, as observed before, has led to further requirements for the role of translators. As Vintaloro points out, translators will increasingly need to become

managers of multilingual translation or editing projects, therefore, they should be able to handle large quantities of texts in a limited time frame. They will need to be able to assess whether it is worthwhile to translate automatically, to assess the amount of post-editing, to subject a text to pre-editing before it is translated, to write translatable texts (controlled writing), to train TA systems or to adapt them to special needs. This means that translators are nowadays required to be editors and proofreaders before and after the drafting of the translation carried out by the machine and, most importantly, project managers.

As mentioned in Chapter 1, according to figures (McKinsey 2018), about 15 percent of the global workforce (400 million workers) could be displaced by automation by 2030, the least susceptible categories being those that involve managing others and providing expertise. Nevertheless, the number of jobs lost to automation will be counterbalanced by the growth in demand for jobs related to new digital skills needed to adapt to the rapidly evolving and increasingly capable machines.

In order to thrive in the workplace of the future, workers will need different skills related to the emotional sphere, such as communication and empathy, which will grow almost as fast as demand for many advanced technological skills. In fact, by automating routine or unsafe activities and those prone to human error – such as the repetitive tasks of correcting MT errors – AI could allow humans to be more productive along with working and living more safely. For this reason, as argued so far, by diverting the translators' attention from repetitive tasks, automated translation will finally allow them to focus on developing the extraordinary traits of our species. In fact, as Vintaloro points out, the act of translating is not a mechanical work but a highly creative one, recognized as such also by the law on copyright, which compares editorial translators to authors. As stated in the Translator's Charter in the section regarding the translator's right: "A translation, being a creation of the intellect, shall enjoy the legal protection accorded to such works". To this the Charter adds that "The translator is therefore the holder of copyright in his/her translation and consequently has the same privileges as the author of the original work" (Translator's Charter, 1994, comma 14 and 15).

As claimed by Lowndes during the "Translating Europe Forum" in Brussels when asked about the possible pitfalls of AI and MT and the possibility of humans becoming lazy: "We could offload our intelligence to machines, or we can see the current challenge which is to move our intelligence to be more sophisticated" (Lowndes 2018). It is

understood, therefore, that the use of AI will force workers to rethink their position in relation to technology and, most importantly, the way they make use of their human intelligence. Particularly interesting to this respect is Gardner's claim that computers will replace individuals with no creative skills (Gardner, 2006: 28). This provocation introduces his theory of the "five minds", a taxonomy of the five different types of intelligence which, according to him, will be necessary to nurture to thrive in the future.

In his book *Five minds for the future*, Gardner expounds upon the notion of intelligence defining it not as a set of specific skills, but as overall mentalities that can be cultivated in schools, companies and professions. These intelligences are labeled as 'disciplined', 'synthesizing', 'creating', 'respectful' and 'ethical' minds.

The disciplined mind relates to the notion of discipline in two senses: one means having craft, profession, skill and involves the expertise which can be replaced either by a machine or a set of rules. For this reason, a second form of discipline is needed, namely to continue to work on one's own skills because, to keep learning, keep refining one's own craft, and keeping up to date with the ever-changing dynamics related to every field. This is, as Gardner explains in an interview, the "*sine qua non* for the survival in the workplace" (Gardner, 2007).

The synthesizing mind serves to decide what is important, what to ignore and how to connect everything together to make sense in order not to lose it. It is very relevant in jobs like that of translators, where the individual is constantly inundated with information, and she/he needs to understand what information is relevant in order to hold on to it and recall it at the right time. This type of intelligence was cited by Lawndes at the 2018 Translating Europe Forum in Brussels, since it makes possible to combine information from multiple sources across disciplines, across people and nowadays more and more increasingly across AI and human intelligence. Therefore, synthesizing in order to reach more advanced understanding is the way that will allow the augmentation of the contribution of AI.

The creating mind, as Gardner observes in the same interview, allows individuals to "think outside the box: in an era where computers are getting smarter and smarter, it's the people who can look at things in a totally different way who will be at a premium" (Gardner 2007).

The respectful mind has to be developed from the early stages of the life of an individual in order to avoid intolerance and prejudice. At a time when billions of people enjoy the option of travelling abroad or encountering other individuals from remote cultures through digital media, this type of intelligence is very relevant to the translators' job. Translators should be responsible for conveying certain messages throughout the world at the same time ensuring that the source meaning is preserved and it does not offend the receiving culture.

Finally, the development of the ethical mind involves an abstract capacity to think of oneself as a worker and a citizen. Not by chance, the knowledge about the translation-localization process described by Jiménez-Crespo entails ethical issues regarding localization, globalization and the role of translators in the society (Jiménez-Crespo, 2013: 177). Moral and ethical reasons are called into question by Künzli when citing Kautz's description of the translator's loyalty to herself or himself, when he mentions the case in which translators refuse a translation job if they fear that it might jeopardise their integrity for moral-ethical reasons (Künzli 2007).

In her blog, Baker (2015) stresses the fact that "the translator and interpreter education has traditionally sidestepped the issue of ethics". As previously mentioned in the quotations from the Translator's Charter, professional codes mainly focus on the relationship between the translator or interpreter and their client and the fulfilment of their request. In this regard, they stress the need for efficiency, impartiality and accuracy. Therefore, the job of the translator is seen from an economic perspective rather than one of social responsibility or human dignity. Nevertheless, as Inghilleri explains:

What is certain, however, is that interpreters and translators have a central role to play in the inevitable clashes that occur in the moral, social, and often violent, spaces of human interaction. (Inghilleri 2009a:20).

In recent years, the broadening of translation studies to take into account not only the textual components of source and target texts but also the contextualization of translation has prompted theorists to examine the political and ideological role of translation. This view encouraging translation studies to widen their focus on people rather than texts has brought to the examination of the idea of the translator as a mediator, that is, a medium

by which texts from one culture and language are transmitted to another, but also a social and ethical agent (Tymoczko, 2006: 457).

Cronin (2003: 64) observes that in the “informational age” in which we are living, the role of the translator is likely to gain importance if s/he is no longer seen as a *communicator* but as a transmitter, meaning that “translators in the modern world are [...] involved in the traditional angelic tasks of transmission, annunciation and mediation”. This mediation cannot neglect the ethical side of the implication of translation. As Rosenberg points out, the invisibility that has characterized translation for centuries could be finally eliminated by recognizing the role of translators in codes of ethics, enabling them to actively participate in social and political contexts (Rosenberg 2016).

According to Gardner, the five types of intelligence presented will be paramount in a world where science and technology permeate the society, enabling the transmission of enormous amounts of information throughout the globe, the performance of repetitive tasks by robots and computers and the increasing frequency of all kinds of contacts between different populations allowed, precisely, by translation. In fact, as Cronin indicates, translators occupy a particular position as they have always been concerned with managing relationships with the world at large, exercising their profession as “lubricants of exchange” (Cronin, 2003: 48).

Finally, on a planet with an increasingly fragile biological and cultural ecosystem caused by the incessant globalization, the role of translators is more real and important than ever, as they become responsible for the conservation of memory, whose loss is seen by Maffi as the greatest danger of late modernity (Maffi 2001: 39). Without translation, as Cronin observes, we are condemned to the most disabling form of “cultural amnesia”, as it allows us to get access to what has been done, said and thought before in other languages and even in our own (Cronin, 2003: 74).

Hence, as was explained throughout the chapter, the development of AI has and will lead to the creation – or retrieval – of new skills in all fields of work, which will be focused on the development of the individual in her/his human peculiarities. The job of translators will not be exempt from the changes brought by AI, and professionals working in this field will be forced to go beyond their reluctance and embrace them. The aim of this chapter was indeed to shed light on the fact that the improvements of technology,

which are usually welcomed with angst and diffidence, should be instead considered as a chance of improvement.

With an original metaphor, Cronin sheds light on one of the most frustrating aspects of translation, the lack of recognition, which he calls the “censorship of experience”. He claims that differently from magicians, who are acclaimed precisely because no one knows what happens in their shows, translators are ignored in their process of transforming “the ingenuity, the skill, the elaborate linguistic lock-picking procedures” into a translation product, because clients do not appreciate the process, as they are just fused on the outcome. (Cronin, 2003: 94)

In the previous chapter, great importance was given to the parameter of style. The data in Fiederer and O’Brien’s research suggest that the post-edited quality can be equal to or higher than human translation quality when clarity and accuracy are taken into account. Yet, when style is included as a parameter of quality, then human translation is preferred over the post-edited product (Fiederer and O’Brien, 2009). This research was important to cite as it shows the extent to which humans are vital in order to produce a valuable and original content. Though when editing MT output translators have to perform mechanic tasks such as correction of MT mistakes, which can be frustrating, the greatest contribution brought by their role in a time where a great hype surrounds the performance of machines is the addition of humanity to an artificial output. Indeed, while the output produced by MT could be adequate to express the meaning and the gist of the message to be delivered, the parameter of style would be negatively affected by the absence of the human touch. In the e-commerce domain, especially in fields where many vendors sell the same items, people need a special and different content in order to be convinced to buy a product they could buy anywhere else, so there must be a clear reason to ‘stick’ to a certain website.

Though sometimes they are not much taken into consideration, style and language are essential features to consider in a website, because it is through them that a website talks to the world and has the chance to transform visitors into customers. For this reason, Fiederer and O’Brien’s claim that “many end users may not care much about *style* as long as they can access and understand the information they need” (Fiederer and O’Brien, 2009) could be objected if language is considered as a distinguishing factor for obtaining a certain outcome – a purchase or a new contract, in the case of e-commerce websites. To

sum up, the process, the creativity, the choices that lead to a certain translation outcome are the result of skills and expertise acquired with a process of education and experience of human translators, which can in no ways be substituted by machines. Hence, it is worth repeating that the developers themselves, who work steadily for the improvement of artificial intelligence, claim that human translators will always be the central part of the process, the core element that allows machines to improve and produce better results. Indeed, when asked about the possibility of MT threatening the job of human translators, Way claims that “the last thing we [developers] want to do is alienating the translators [...]. The translators will always be [...] the most important part of the translation pipeline”. (Way 2017)



## CONCLUSION

The aim of this dissertation has been to shed light on the changes brought by AI to the job of translators, who fear that technology will eventually replace them. By comparing different MT tools such as Google Translate, DeepL, Systran and so forth, it has been suggested that this worrisome view might be changed into a new perspective, where machines do not represent a threat but rather a great help for humans. MT developers themselves claim to be working to build technologies that fit into society and can have a positive impact on humankind, recognizing the paramount importance of translators. Indeed, as Way claims in an interview: “If we think for one moment where we would be without translators, we wouldn’t even be able to start” (Way 2017).

The main question addressed in the thesis is what is left for human translators in an era of technology disruption where machines and AI seem to be taking over all spheres of work. The question has been addressed by showing that not only does technology allow translators to be faster and, thus, more productive, but it also gives room to more involving and not so frustrating tasks. The impact of Neural Machine Translation and the evolution of translators’ role from translation to edition is a widely-discussed topic among scientists and developers, focus of meetings and conferences.

The thesis has stressed the fact that MT is essential to allow translators to perform their job, since too much material needs to be translated today, and translators would never be able to meet such a huge demand. Along with speeding up the production, it has been shown that MT tools are also improving the quality of translation, not only by providing translators with dictionaries and translation memories, but most importantly, by suggesting new ideas for translation. Indeed, by means of snippets of texts taken from the website, the work has demonstrated that not only does NMT deliver a significantly better output than SMT, but it also suggests new possible ways to translate some parts of speech or even sentences. Natural language processors and machine learning neural translators like Google Auto ML were presented to show how AI and machine learning can be exploited by translators to save time and achieve a better translation output.

By presenting deep learning and an overview of NMT tools, Chapter 3 argued that one of the major changes in the translators’ job relates to the ability to handle data in order to become qualified ‘trainers’ of machines. Since machine learning is based on artificial neural networks, which loosely model the way that neurons interact in the brain,

it requires large amounts of human effort to label the training data necessary for supervised learning. As argued throughout the thesis, despite being much better than the output of SMT, NMT translations are far from perfect, nevertheless errors are not to be seen as something frustrating, time-consuming and thus to avoid, but rather as an opportunity to look for creative solutions in order to train the machine, which will not repeat them again. Without errors, there would be no space for improvement. This implies a profound change in the role of translators, who will not only have to be more and more sensitive to technological issues and possess analytical competence, but will also have the opportunity to re-invent themselves, developing important skills regarding emotional intelligence, ethical intelligence and so forth. These new skills have been the focus of Chapter 5, where it is argued that the already known competences and subcompetences possessed by translators, – communicative, cultural or research competence, for instance (Jiménez-Crespo, 2013: 168) – will not be sufficient in a not so far future where the presence of machines is bound to be so pervasive. Competences including empathy and teamwork differentiate human capabilities from the work of AI and machine learning. As suggested by Goleman, AI will continue to automate logic-based tasks, such as diagnosing medical cases or managing investments, but the human side that involves understanding, engaging, and interacting with others – the skills that build emotional intelligence – will become increasingly critical. As the pace of AI development accelerates, the ethics and empathy that guide those designing the technology of our future will have far-reaching consequences (Goleman 2018). As Cronin (2003: 116) suggests, the most likely outcome of this perspective is the transformation of translators in “translational cyborgs” where the levels of interaction between humans and machines become deep and complementary. Therefore, translators will be required to creatively engage with MT systems, which will help them increase their productivity, by making the collaboration with MT more acceptable and helping to address the huge mismatch between language needs and supply. The use of MT tools in daily activities will make translators faster and, most importantly, able to focus on the “human parts” of their jobs, namely, those aspects that require their expertise and creativity. As Ken Robinson claims, we cannot afford to throw away the creative potential in an age where art is given so much importance, and continue to cradle ourselves in the idea that the market works alone and that we only need ‘technicians’.

My assertion is that machines should not be perceived as a menace, but rather as something built *by* human beings *for* human beings. The goal of this thesis was indeed to show that the claims that have been repeated in the mainstream tech press promising world-changing results should not be perceived as a threat by translators, but rather accepted as a help in increasing their value for the tasks where the human brain can excel. It is no coincidence that the keynote speech held by Benammar on day two of the “Translating Europe Forum” highlighted the importance of personal perspective. It also stressed the need of “reframing translation”, by embracing the change from the human translation paradigm – based on developed skills, lived experience and consciousness – to the machine translation paradigm – characterized by incredible speed, massive database and algorithms. By asserting that to change a paradigm is a sort of translation – reframing is, indeed, a form of shifting from one frame to the other frame – the philosopher means that shifting from one paradigm to another one is not necessarily a negative thing, since much improvement can be achieved from this change. Benammar suggests a new alliance between the skills of humans and those of machines, where translators embody the “translational cyborgs” envisioned by Cronin (2003: 116). Hence, he suggests a ‘centaur’ version of translation, where there is no AI but IA, (Intelligence Augmented), and the skills which belong to the humans merge with those ascribed to the machines. When presenting this ‘centaur’ version, he claims that the result of the combination of the strength of humans and machines will always beat the outcome of the work performed by machines alone.

Certainly, the shift from a paradigm to a new one is not easy and requires sacrifice and endeavour but, as optimistically observed at the same conference: “When you make the change, it is always for the better” (Lowndes 2018). The following claim by Luckin – still taken from that conference – invites translators to be receptive to change, stressing the fact that this job requires constant development:

There is no reason why the translators’ job would be static. There will be not job losses, unless people will not be willing to look at things slightly differently, having a mindset which embraces the training and constantly developing professionally. As long as people are encouraged to have this mindset and are encouraged to make best use of what AI can offer, than it can be enjoyable and lead to much more sophisticated understanding of languages and interpretations. It is about embracing change. (Luckin 2018)

Lastly, this thesis suggests that, despite the hype and fear surrounding AI in particular with respect to the job of translators, technology should not be feared, but rather considered as a benefit and a support to mankind. After all, as computer scientist Och (Spiegel Online, 2013) observed when asked about his dream of breaching the language barrier: “Machine translation makes a lot of information accessible for many people, and that makes many other things possible.”

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## RIASSUNTO IN ITALIANO

Questo lavoro di tesi nasce dalla volontà di investigare come i recenti progressi tecnologici nel campo del *machine learning* applicato alla traduzione automatica (MT, dall'inglese *machine translation*) stanno rivoluzionando il ruolo del traduttore nella sua complessità. L'intento di questo studio è dimostrare che, per quanto i continui miglioramenti nel campo dell'intelligenza artificiale stiano mostrando risultati strabilianti anche nel campo della traduzione, i traduttori umani non potranno mai essere sostituiti dalle macchine, poiché il risultato finale di una traduzione di qualità non può prescindere dal fattore umano.

I progressi apportati dalla digitalizzazione e la caduta delle barriere commerciali come effetto della globalizzazione richiedono inevitabilmente anche l'abbattimento delle barriere linguistiche. L'avvento di Internet, che ha diffuso aspettative di risposta o esecuzione immediata rendendo praticabili innumerevoli attività ventiquattro ore al giorno, sette giorni su sette, ha permesso un aumento esponenziale della diffusione di informazioni in tutto il mondo. Una conseguenza inevitabile di tale fenomeno è l'incessante aumento del materiale da tradurre, di attività di traduzione e localizzazione di contenuti digitali rivolti a nuovi mercati. L'incremento di domanda che i traduttori e le agenzie non sono numericamente in grado di soddisfare (McKinsey 2018), ha portato all'elaborazione di strumenti per la traduzione assistita (i cosiddetti *CAT tools*, come memorie traduttive, basi terminologiche e via dicendo), che nel corso dei decenni hanno aperto la strada alla traduzione automatica (TA), o MT (dall'inglese *Machine Translation*). Nel 2016, Google dichiarò di essere in grado di tradurre 140 miliardi di parole al giorno, in più di 100 lingue diverse. Da questi dati si può dedurre che il mercato della traduzione si stia espandendo, se non esplodendo, e lavorare al giorno d'oggi nel settore della traduzione senza far uso di strumenti tecnologici è ormai impensabile.

I primi esperimenti di traduzione automatica erano basati su un approccio *rule-based*, dove il testo di partenza veniva scomposto etichettando i singoli lemmi e trasformandoli nei loro equivalenti nella lingua di arrivo. Successivamente si passò dalla scomposizione dei singoli lemmi alla comparazione statistica di *corpora* paralleli nella lingua di partenza e in quella d'arrivo. Questo nuovo modello di traduzione automatica statistica (SMT, *statistical machine translation*) offre tra i suoi vantaggi una maggiore scorrevolezza della traduzione. Tuttavia, poiché il sistema attinge a *corpora* diversi durante il processo

traduttivo, la terminologia può non sempre risultare coerente con il dominio di riferimento. Per questo motivo, i sistemi possono essere ‘addestrati’ con testi propri e costantemente integrati con nuove traduzioni affinché la terminologia di riferimento risulti coerente con quella del settore a cui si è interessati.

Negli ultimi due anni i successi nel campo dell’intelligenza artificiale hanno provocato una vera e propria svolta nel campo della traduzione, permettendo la nascita della traduzione neurale. Tra settembre e novembre 2016, infatti, Google, Systran e Microsoft, seguiti dopo qualche mese da Facebook, hanno annunciato la nascita di nuovi sistemi di traduzione automatica basati su reti neurali artificiali, affermando che questa tecnologia sarebbe in grado di produrre traduzioni molto più accurate, tanto da essere paragonate a quelle prodotte da traduttori umani. Tale affermazioni, assieme ad allarmanti previsioni come quella del futurologo e cibernetico Kurzweil, il quale arrivò a predire che dal 2029 la traduzione automatica sarà in grado di rimpiazzare gli esseri umani, hanno causato non pochi allarmismi nel mondo della traduzione. Sebbene le agenzie di traduzione, i traduttori freelance e in generale tutti coloro che operano in questo settore siano ormai avvezzi all’uso della tecnologia, molti di loro percepiscono gli avanzamenti in campo tecnologico come una minaccia (Mossop 2017). Le principali preoccupazioni sono legate alla paura di essere soppiantati dalle macchine, percepite appunto come una minaccia alla propria professione. I dati, tuttavia, affermano che la creazione di macchine sempre più evolute in tutti i settori implicherà una crescita esponenziale della domanda di professionisti con competenze digitali, la quale supererà di gran lunga il numero di lavori persi a causa della meccanizzazione. (McKinsey 2018), (CSA 2018) I numeri quindi non lasciano presagire alcun pericolo per i traduttori. Senza dubbio, i progressi nel campo dell’intelligenza artificiale e nel *machine learning* implicheranno non pochi cambiamenti nel loro ruolo, che li vedrà trasformarsi sempre di più in *post-editor* delle traduzioni automatiche. Il *post-editing*, che secondo le previsioni (CSA Research 2018) acquisterà un’importanza sempre maggiore nel lavoro dei traduttori negli anni a venire, è il processo in cui il traduttore umano, una volta ricevuto il testo tradotto dalla macchina, lo modifica apportando correzioni e miglioramenti. La crucialità della fase di *post-editing* della traduzione automatica lascia intendere che l’uso dell’intelligenza artificiale, invece di rubare lavoro ai traduttori, permetterà loro di esprimere a pieno le loro qualità laddove solamente l’essere umano può eccellere, portando quindi un apporto creativo e personale

in questo processo. Sarà proprio compito del traduttore uscire dal sentiero precostruito dalla macchina senza farsi influenzare (in quello che Picinini e Ueffing definiscono *cognitive bias*), restando fedele a se stesso e adattando lo stile della macchina al suo.

La traduzione neurale è un tema caldo discusso in convegni organizzati in tutto il mondo. Non a caso, il “Translating Europe Forum” tenutosi l’8 e 9 novembre 2018 a Bruxelles presso la sede dell’Unione Europea, ha avuto come oggetto di discussione la traduzione neurale e il suo impatto nella vita professionale dei traduttori. Professori, ingegneri e scienziati hanno convenuto sul fatto che l’obiettivo della ricerca nel campo della traduzione automatica non è quello di sostituire la competenza umana, ma al contrario di permettere agli esseri umani di esprimere il proprio potenziale e le proprie competenze, creando nuove tecnologie affinché ciò avvenga. Sulla scia di questi ragionamenti l’obiettivo di questa tesi è dimostrare che l’angoscia dei traduttori dovrebbe tradursi in una nuova prospettiva, che consideri i progressi tecnologici non come minaccia, ma piuttosto come valido aiuto alla propria vita professionale e individuale. I ricercatori sostengono che automatizzando compiti noiosi e frustranti (e per questo soggetti ad errori umani) come quello di correggere gli stessi errori o tradurre migliaia di volte la stessa parola, l’intelligenza artificiale consentirà ai traduttori di essere più produttivi, dando loro l’opportunità di investire il tempo risparmiato nello sviluppo di competenze fondamentali nella traduzione, come, ad esempio, la creatività. Per dimostrare l’importanza che il ruolo dei traduttori continua ad assumere in quest’epoca dove la tecnologia sembra prendere il sopravvento, diversi strumenti di traduzione automatica (quali Sysran, SDL Trados, Google Translate, DeepL e Amazon Translate) vengono confrontati nelle loro performance. Il materiale da tradurre è estratto dal sito [www.alfiolago.com](http://www.alfiolago.com), il sito *e-commerce* della gioielleria dove sto attualmente lavorando, in seguito alla richiesta dei proprietari di tradurre il loro sito in lingua inglese. La traduzione di un sito web tuttavia non è un processo semplice e diretto, bensì deve tener conto di innumerevoli fattori, che sono descritti nella prima parte del lavoro con la presentazione del processo di localizzazione.

Una parte del lavoro è dedicata al confronto dei vari strumenti di traduzione automatica sopra elencati, analizzando il ruolo giocato dalla tecnologia nel processo di traduzione, concentrandosi sulla fase del *post-editing* e, infine, sulle nuove competenze richieste ai traduttori in quella che viene definita l’*AI era*, l’epoca dell’intelligenza artificiale.

Oltre alla parte puramente operativa, in cui i diversi strumenti di traduzione vengono confrontati nelle loro performance, il presente lavoro è motivato dal tentativo di rispondere alla seguente domanda, espressa nel titolo della tesi: cosa resta al traduttore umano in un'epoca in cui la decantata efficienza delle macchine e dell'intelligenza artificiale è così pervasiva? Se l'avvento di Internet ha portato nuovi strumenti per la soluzione dei problemi, ha anche dato origine a nuove complicazioni per i traduttori, che vedono la traduzione automatica come una minaccia alla loro professione. Il processo cognitivo coinvolto nella traduzione viene analizzato seguendo protocolli di tipo *think-aloud*, in particolare durante il lavoro di *post-editing*, con lo scopo di dimostrare che il fattore umano è (e sarà sempre) vitale nel processo di trasformazione del linguaggio, a causa di tutte le sue sfumature e complessità.

La tesi è strutturata in cinque capitoli. Poiché il materiale oggetto di traduzione è tratto da un sito di *e-commerce*, il Capitolo 1 inizia con una panoramica sul mondo del commercio elettronico, esponendo dati sui trend digitali e l'impatto della digitalizzazione nella vita quotidiana. I consumatori di oggi sono ormai avvezzi al concetto di shopping online, grazie all'uso di computer e in particolare alla diffusione degli *smartphone*. Di conseguenza, chiunque possieda un sito *e-commerce* dovrebbe essere pronto a sfruttare le opportunità offerte dai nuovi strumenti digitali, internazionalizzando il proprio sito web per raggiungere un pubblico più ampio. Da ciò consegue che la richiesta di materiale da tradurre aumenterà negli anni a venire, portando ad una crescita del mercato della traduzione (CSA 2018). In uno scenario in cui gli utenti vengono sovraccaricati con un'enorme quantità di dati da elaborare, a causa della vasta gamma di informazioni reperibili e la possibilità di consultare più siti web contemporaneamente, i traduttori sono tenuti a conoscere il loro target di lettori e le loro abitudini e aspettative, insieme alle convenzioni caratteristiche di un genere peculiare come quello del sito web. Per far luce sugli aspetti culturali da prendere in considerazione nella localizzazione web e nella traduzione in generale vengono introdotte le dimensioni di percezione, simbolismo e comportamento di Hofstede. Queste ultime, applicate nella comunicazione internazionale, nelle trattative, nel management internazionale e nel marketing, mirano a fornire spunti di riflessione per l'analisi di altre culture al fine di facilitare la comunicazione interculturale, la quale non può prescindere dalla consapevolezza delle differenze culturali tra i diversi paesi del mondo.

Il capitolo 2 si concentra sulla storia della traduzione automatica, descrivendo i miglioramenti in questo campo dai primi esperimenti fino alle attuali conquiste nella traduzione neurale. Nonostante i periodi di significativi progressi scientifici nei sei decenni successivi agli anni '50, quando vennero effettuati i primi esperimenti nel campo, i risultati della traduzione automatica non sono stati all'altezza di ciò che ci si aspettava. Oggi, tuttavia, dopo un susseguirsi di periodi di entusiasmo e disillusione, stiamo assistendo a un cambiamento di paradigma permesso dal *machine learning* (apprendimento automatico). Il *machine learning* è strettamente legato al riconoscimento di modelli ed esplora lo studio e la costruzione di algoritmi che possano apprendere da un insieme di dati e fare delle predizioni su questi ultimi, costruendo in modo induttivo un modello basato a sua volta su altri modelli. Lo scopo del *machine learning* è infatti permettere agli algoritmi di 'imparare' concetti complicati costruendoli da concetti più semplici. Gli algoritmi di apprendimento automatico sono progrediti soprattutto attraverso lo sviluppo di tecniche di *deep learning* (apprendimento profondo) e di rinforzo basate su reti neurali. *Deep learning* è il termine con cui viene indicata una particolare classe di algoritmi per l'apprendimento automatico delle macchine, che utilizza le reti neurali. Queste ultime sono delle reti artificiali che imitano quelle del sistema nervoso umano, lavorando parallelamente su un insieme di dati. La loro peculiarità è quella di essere in grado di acquisire 'esperienza', organizzandosi sulla base di esempi e modelli. A differenza dei sistemi informatici statici, che si basano su dati statistici e di frequenza, le reti neurali si avvicinano molto alla logica umana, apprendendo dall'esperienza e migliorandosi continuamente. Per questo, l'apprendimento dei sistemi neurali necessita di una quantità enorme di dati. Di conseguenza, l'apprendimento automatico può richiedere grandi sforzi umani per selezionare i dati necessari all'apprendimento dei sistemi, da cui consegue uno dei principali cambiamenti nel lavoro dei traduttori, che richiede loro di essere in grado di gestire i dati per diventare degli 'allenatori' di macchine qualificati.

In seguito alla presentazione della storia e dei progressi raggiunti dalla tecnologia nel campo della traduzione automatica, il capitolo 3 illustra gli strumenti di traduzione automatica utilizzati per questo progetto. Systran e SDL Trados sono tra i fornitori di servizi linguistici più utilizzati e citati sul mercato (CSA 2018). Assieme a loro, si è deciso di confrontare DeepL, Google e Amazon Translate, strumenti di traduzione automatica

neurale all'avanguardia. Dal confronto tra frammenti di testo estratti dal sito web [www.alfiolago.com](http://www.alfiolago.com) viene dimostrato che la traduzione automatica neurale (NMT) fornisce un output significativamente migliore rispetto a quella statistica (SMT). Attraverso la presentazione di strumenti come memorie di traduzione e strumenti di elaborazione del linguaggio naturale si mostra come l'intelligenza artificiale e il *machine learning* possano essere sfruttati dai traduttori per ottimizzare il loro tempo e ottenere un miglior risultato.

Il capitolo 4 presenta i principi che governano il processo di *post-editing*, dove un traduttore umano è incaricato di modificare e migliorare il risultato di una traduzione automatica. Le cinque linee guida di Mossop (2007), che includono modifiche di struttura, di contenuto, di stile, copyediting e infine il controllo della coerenza, vengono presentate assieme al processo cognitivo analizzato con metodo *think-aloud*, che si propone di comprendere ciò che attraversa la mente del traduttore durante il processo traduttivo. Tradurre un testo non significa solamente sostituire parole, ma richiede un'attenta considerazione di diversi criteri. Infatti, poiché la comunicazione è estremamente complessa e legata al contesto, affidarsi alla sola traduzione automatica significherebbe ignorare tale complessità. Pertanto, il lavoro di *post-editing* da parte di un traduttore umano diventa vitale per garantire che una traduzione generata da una macchina raggiunga una qualità soddisfacente.

Il notevole miglioramento delle traduzioni prodotte da sistemi che adottano intelligenze artificiali lasciano intravedere un futuro (non poi così distante) in cui i traduttori verranno sollevati da compiti frustranti e ripetitivi (come correggere svariate volte lo stesso errore) per affrontare mansioni intellettualmente più stimolanti. Secondo varie ricerche, se i compiti più meccanici del lavoro dei traduttori verranno svolti da macchine, sarà lasciato molto più spazio alla creatività umana (O'Brien 2009), (Jiménez-Crespo 2013), (Bentivogli 2016), (Agrawal 2018), (Senellart 2018). Infatti, la traduzione automatica neurale richiederà ai traduttori di diventare 'allenatori' delle macchine, selezionando con cura "dati puliti" con cui alimentare i sistemi (Post 2018). Il traduttore, di conseguenza, si trasforma in una sorta di insegnante le cui competenze sono essenziali per permettere alle macchine di apprendere, in quello che cioè è il processo di *machine learning*.

Secondo quanto emerso al convegno "Translating Europe" a Bruxelles, ci sono due ingredienti chiave per ottenere una traduzione neurale di qualità, ossia i dati e le persone.

(Pouliquen 2018). Mentre nella traduzione statistica la quantità di dati (quindi la dimensione dei *corpora*) era il fattore predominante di cui tener conto per la buona riuscita di una traduzione, ciò che conta nella traduzione neurale è che i dati siano “puliti”, ovvero selezionati nel modo più accurato possibile per fornire alla macchina una base di qualità da cui apprendere. Affinché questo avvenga, il contributo umano diventa fondamentale. È infatti la capacità intellettuale umana a capire cosa fare con i dati e a manipolare gli algoritmi per ottenere risultati sempre migliori. Per approfondire questo tema, tanto attuale quanto dibattuto, ho provato ad allenare gli algoritmi di Google Auto ML Translation, sfruttando l’intelligenza artificiale di Google e il *machine learning* per tradurre parti di testo tratte dal sito *e-commerce* [www.alfiolago.com](http://www.alfiolago.com).

AutoML Translation permette di creare modelli personalizzati di traduzione utilizzando coppie di frasi corrispondenti nella lingua di partenza e in quella di arrivo. La maggior parte del lavoro viene impiegata nella preparazione dei dati con cui allenare la macchina, in quanto il traduttore deve selezionare attentamente lemmi, frasi ed espressioni che corrispondano al risultato che vuole ottenere. Il processo vero e proprio di *machine learning* inizia una volta caricato il set di dati con cui creare un modello personalizzato, e può durare diverse ore in base alla complessità di tale set.

In conclusione al processo, confrontando il modello personalizzato e quello fornito di default da Google, si evince che l’output fornito dal motore neurale è accurato e chiaramente superiore a quello dei precedenti sistemi di traduzione statistica, sebbene richieda *post-editing* per quanto riguarda la fluidità, il posizionamento delle parole e la correzione di termini tecnici. Il *machine learning* gioca un ruolo chiave in questo senso, in quanto la possibilità di creare modelli personalizzati permette di impostare alcuni parametri (ad esempio la traduzione di alcune parole tecniche) per ottenere il risultato desiderato senza bisogno di ulteriori modifiche. L’alta qualità complessiva del modello proposto da Google AutoML dimostra che gli enormi miglioramenti nel campo del *machine learning* fanno sì che la traduzione neurale diventi uno strumento essenziale per i traduttori, sia per sollevarli dall’enorme quantità di contenuti da tradurre in un tempo limitato, sia soprattutto da compiti meccanici e frustranti come la correzione di errori che possono facilmente essere evitati. Pertanto, la combinazione dello sforzo umano applicato nella preparazione dei dati per alimentare il sistema e la profonda capacità di apprendimento delle macchine neurali può rappresentare un grande aiuto per accelerare

la traduzione di testi ripetitivi, come le descrizioni dei prodotti nei siti di *e-commerce*. Di conseguenza, se si vuole ottenere dalla macchina un output di qualità, le competenze e l'esperienza dei traduttori sono e continueranno ad essere necessarie per il reperimento e la preparazione di dati precisi con cui addestrarla.

Il quinto e ultimo capitolo conclude il lavoro con una disamina delle competenze che verranno richieste ai traduttori per stare al passo con un mondo in continua evoluzione. Oltre alle conoscenze dichiarative e operative descritte da Jiménez-Crespo (2013), i traduttori dovranno possedere una gamma di competenze diverse per affrontare i nuovi cambiamenti apportati dall'intelligenza artificiale in uno scenario economico, politico e sociale così mutevole. Le competenze tecnologiche, procedurali e manageriali dovranno infatti essere affiancate da quelle legate alla sfera emotiva, come la comunicazione e l'empatia. Nel suo libro *Five Minds for the Future*, Gardner indica come e in quale direzione promuovere i nuovi processi educativi richiesti dai cambiamenti che stiamo vivendo, i quali hanno a che fare con il potere della scienza e della tecnologia e con l'inesorabilità della globalizzazione. Le cinque intelligenze chiavi di cui Gardner postula l'esistenza (ovvero intelligenza disciplinare, sintetica, creativa, rispettosa ed etica) vanno immaginate come mentalità complessive che possono essere coltivate nella scuola, nelle aziende e nelle professioni, e saranno di primaria importanza in un mondo in cui la scienza e la tecnologia permeano la società.

I progressi dell'AI, invece di essere considerati una minaccia dovrebbero essere accolti come una sfida: dopotutto, l'umanità ha affrontato i cambiamenti tecnologici fin dalla notte dei tempi, e la tecnologia ha da sempre accompagnato l'umanità nei suoi progressi. Buona parte del progresso tecnologico, infatti, è volto a ridurre il tempo necessario per una certa operazione, perseguendo obiettivi di risparmio (o profitto) economico, reale o percepito. Alla stregua delle innovazioni dell'era industriale, le quali permisero alle macchine di eseguire una varietà di compiti fisici che prima venivano eseguiti manualmente, così l'avvento di macchine programmabili sta rendendo possibile l'automazione di compiti mentali ripetitivi e poco stimolanti. Inoltre, le tecnologie di *cloud computing*, consentendo l'accesso ubiquo a contenuti digitali multilingui e a diversi strumenti di traduzione, hanno permesso la diffusione di "comunità di traduzione", ossia nuove modalità di lavoro collaborativo i cui partecipanti, pur a distanza, possono lavorare contemporaneamente sullo stesso documento servendosi di risorse linguistiche e

strumenti condivisi e aggiornati di continuo. In questo modo, la traduzione non viene più considerata un lavoro solitario d'ufficio relegato ad un singolo agente, ma viene vista nella sua complessità come un processo a cui prendono parte vari protagonisti, che si servono del potere unificante della tecnologia per rendere sempre più efficiente un lavoro eterogeneo e creativo come quello del traduttore.

In conclusione, sebbene la traduzione neurale offra risultati strabilianti e molto più accurati rispetto agli approcci precedenti, è difficile immaginare una forma di traduzione automatica che possa sostituire del tutto l'essere umano. Nel caso della traduzione letteraria, per esempio, il contributo umano del traduttore è fondamentale nell'interpretazione del testo, oltre che nella resa dello stile e della forma. Rifacendoci all'etimologia della parola 'tradurre', dal latino 'tradúcere', cioè "far passare", da trans al di là, e dúcere, condurre, possiamo considerare l'attività della traduzione come mero trasferimento di parole da una lingua ad un'altra. Questo processo, come si è discusso in questa tesi, è ormai reso possibile anche alle macchine grazie ai costanti miglioramenti tecnologici. Tuttavia, analizzando in modo più approfondito la parola, si percepisce come il traduttore si configuri come 'conduttore', ovvero "colui che conduce", diventando quindi una vera e propria guida nel processo traduttivo. Al momento, infatti, le macchine non sono in grado di replicare la componente emotiva, espressiva e creativa propria degli esseri umani, che consiste nel loro valore aggiunto rispetto alle macchine. Da ciò risulta che, nonostante i continui progressi nel campo della tecnologia, il traduttore sarà sempre essenziale per la riuscita di una traduzione di qualità. Il suo ruolo, tuttavia, non può prescindere dai costanti mutamenti della società. Per prosperare in questa "modernità liquida", per dirla con Bauman, è perciò necessario adattarsi al cambiamento. Ecco che il concetto del 'tradurre' può essere esteso dal linguaggio a tutte le sfere della vita, personale e professionale. Riprendendo la figura del 'centauro', il filosofo Benammar propone una versione ibrida di traduzione, dove non è l'intelligenza artificiale, bensì l'intelligenza aumentata (AI, *augmented intelligence*) a fare da padrone. In questa visione, dove le competenze proprie degli esseri umani sono in simbiosi con quelle delle macchine, si creerà un nuovo paradigma in cui i livelli di interazione tra l'uomo e le macchine diventano più profondi e "i punti di forza di ognuno sono in relazione a quelli dell'altro in maniera ottimale e complementare" (Cronin, 2003:116 [traduzione mia]). Per citare ancora una volta quanto emerso al convegno di Bruxelles, non ci saranno perdite di posti

di lavoro, se i traduttori (e non solo) saranno disposti a guardare le cose in modo leggermente diverso, con una mentalità che abbraccia la formazione e un costante sviluppo professionale. Si tratta quindi di riconcettualizzare il lavoro del traduttore, incoraggiando ad adottare questo tipo di *mindset* e utilizzare nel migliore dei modi ciò che l'intelligenza artificiale può offrire. Ne consegue che questo cambio di paradigma non può essere vissuto in modo passivo, bensì prendendo consapevolmente in mano le redini della propria vita personale e professionale, e approfittando del nuovo tempo concesso dall'apporto dalle intelligenze artificiali per dedicarsi a quelle attività stimolanti e creative che non potranno che migliorare il nostro essere "umani".

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