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Video Game and Application Software Localization: Case Study Analysis of Socio-technical and Linguistic Aspects Towards New Professional Profiles and Educational Pathways

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Abstract

The thesis focuses on linguistics applied to the computer field. On this area, in particular, the software localization process is relevant, as it describes the linguistic and cultural adaptation of an information technology product to a specific market scenario. This research, conducted from an interdisciplinary perspective, is related to the localization process in video games and, in a broader sense, to application software localization.

Software and video game localization is experiencing a period of strong growth due to high market demand and the current trend to make computers more human-like in the way they interact with users. In this scenario, the thesis focuses on "linguistic" localization by addressing the language translation process from the perspective of translation studies, with particular reference to the process of translating the language assets in digital products, making them linguistically and culturally appropriate for the target market. As these aspects also involve technological assessments, also the main reference technical methodologies and tools will be explored.

Starting by highlighting the main tools and methodologies currently used in software and video game localization, this study would focus on discussing the main issues and open challenges in this field, even considering the reference studies in comparative linguistics and culture related in video game localization.

In this direction, in order to obtain up-to-date quantitative and qualitative data, a hybrid methodology has been used to perform literature review and meta-analysis, combining the PRISMA statement with a focus group that see involved both academic and professional experts in software and videogame localization.

Furthermore, this research would investigate some peculiar linguistic and cultural aspects of videogames, also analysing selected products with a case study approach.

The main objective of the thesis would be to reduce the gap between the linguist and the programmer, by redefining the way in which they collaborate; in fact, versatile specialized professional figures in this field are not easy to find, since it would require competencies in both information technology, linguistic and also intercultural fields.

The obtained results allowed to define some useful competences for new or existing professional figures (perhaps also proposing some guidelines with the purpose to contribute in standardize specific educational pathways), in the attempt to obtain an improved quality of the products.

Keywords: Video games, Localization, Interactive Storytelling, Transmedia Narrative, Accessibility.

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Introduction

In an increasingly globalized world, the need for cross-cultural media such as software and video games is more important than ever. The process of adapting these digital products to different languages and cultural scenarios, known as localization, is not only a technical one, but is deeply intertwined with linguistic, cultural, and social aspects. As the demand for localized products increases, so does the complexity of the challenges involved in ensuring that software and video games are accessible and functional in different markets.

The main objective of this dissertation is to address these challenges from an interdisciplinary perspective, providing a detailed examination of the current state of the art in software and video game localization.

By conducting a systematic review of the literature, mixing both quantitative and qualitative research methods, this study aims to provide a comprehensive understanding of the field, highlighting gaps in current knowledge, also proposing new methodologies and solutions in the attempt to overcome the main obstacles and problems in the localization processes. In this regard, the thesis will be composed of six chapters, each one focusing on a specific aspect of the field.

The first part of this research provides a systematic review of the existing literature in software and video game localization using the *PRISMA methodology***,** which would ensure a transparent and reproducible approach to source selection and analysis. In fact, the *PRISMA framework* is particularly indicated for conducting studies that assess broad and evolving fields, where the literature extends across disciplines, such as linguistics, computer science, media and cultural studies.

The review is based on a hybrid meta-analytic structure that combines quantitative analysis (focusing on empirical data related to modern localization trends, including challenges and outcomes) with qualitative insights from a focus group discussion involving both industry professionals and academics. This combination provides a truly holistic view of the localization

landscape, focusing not only on measurable trends and patterns, but also on the more subjective, experiential understanding that is often lacking in data-driven studies.

This type of systematic review will identify key areas of concern in the current state of localization practices, also in relation to the increasing demand for new localization professionals capable of localizing non-linear storylines or culturally dense content, including the need for more accessible and inclusive localization practices for digital products. This study was also published by the publisher *MDPI* in the journal *Information* (Pirrone & D'Ulizia, 2024).

The second and third sections of the thesis focus on the background and key concepts of the localization and internationalization processes themselves. In fact, localization is not only concerned with the translation of sentences from one language to another; it is about ensuring that localized digital products are culturally appropriate, functionally equivalent, and attractive to the target audience. This requires a combination of technical, linguistic, and creative skills that should be supported by a variety of approaches and tools.

In this part of the study, a detailed overview of the main methodologies and tools used in the localization process is provided. These tools and methodologies include software localization platforms, specific translation memory tools, and project management systems designed to streamline the entire process of adapting complex digital products. In this regard, special attention will be given to how these tools are rapidly evolving to meet the needs of an industry that increasingly relies on rapid, iterative development cycles and real-time updates.

In parallel, this section also explores the linguistic dimensions of localization, with particular reference to comparative linguistics, parallel corpora, and micro-languages. In particular, comparative linguistic studies play an important role in localization, as they help to identify and address differences in language structures that may complicate the adaptation process. For example, the relationship between the Italian language and the computer science lexicon is studied, revealing how both technical jargon and idiomatic expressions often resist direct translation and require a high degree of creative adaptation.

Furthermore, the exploration of parallel corpora (which substantially are large collections of translated texts in multiple languages) offers relevant insights into best practices for software localization, particularly when dealing with complex textual content of video games. Micro-

languages, or domain-specific sublanguages, also present peculiar challenges, specifically in highly specialized fields like video game development, where dialogues, user interfaces, and manuals might use a specific terminology which could result unfamiliar to general translators.

Built around the theoretical and methodological basis established in the previous sections, chapters 4 and 5 will focus on case studies approaches and empirical results in video game localization. These sections analyse three reference genres of video games, each selected for their specific localization challenges and innovative solutions. By examining these cases, this research provides real-world examples of the way in which localization teams navigate the technical, linguistic, and cultural obstacles during their work.

Each case study is followed by some related applicative proposals, suggesting concrete strategies in the attempt to improve the localization process. For instance, these proposals also explore the potential of innovative technologies such as machine learning and other AI-based tools adopted to automate peculiar aspects of localization, particularly in handling large text portions or in identifying cultural sensitivities that might require human supervision.

This section of the thesis also describes broader issues and challenges that could affect modern localization practices. In this direction, creativity would be a central topic, specifically in narrative-driven products like video games, where translation should not only convey meaning, but also evoke emotion while maintaining coherence with the native storytelling intents. The concept of transmedia storytelling, where stories unfold across multiple medial form and platforms (i.e., video games, movies and comics), introduces a higher level of complexity, as localization efforts should have to ensure that narratives remain consistent across different cultural scenarios and media formats.

In addition, these chapters discuss specific issues related to accessibility and the gender gap. For example, localization should truly consider how to create accessible digital products for users with disabilities, including visual, hearing, or cognitive impairments. Also, the representation of gender in localized software raises several questions about the concepts of inclusivity and diversity, which are becoming relevant components of ethical localization processes.

The final section of the thesis reports a discussion of the findings and their related implications in the localization industry. This has also been possible thanks to the contribution of two interviews kindly granted by both academics and professional profiles in the field. Considering the results of the case studies and the literature review, this research highlights a number of relevant skills and competencies that would be required for both existing and emerging professional profiles in this area. These competencies are not limited to technical and linguistic skills, but they cover cross-cultural communication, project management, other than a profound understanding of user experience (UX) design.

The discussion will also suggest some recommendations and guidelines for academic educational pathways that would be designed to train future localization professionals, providing them with the skills and competencies they will need in this rapidly evolving field. In particular, this work would incentive interdisciplinary academic programs that integrate linguistics, computer science, cultural studies, and media production, with the main purpose to build up a new generation of localization specialists capable of dealing with the modern challenges of global digital marketplace.

In conclusion, this dissertation would address the emerging need for a comprehensive understanding of software and video game localization in relation to the intersection of technology, linguistics, and culture. Through a combination of systematic literature review, case study approaches, and methodological exploration, this research seeks to provide new insights into the challenges and opportunities facing today's localization professionals. By attempting to fill specific gaps in current practice by proposing innovative solutions, the thesis would attempt to contribute to the advancement of localization theory and practice, while offering practical recommendations and suggestions for both industry and academia.

Chapter 1. State of the art and systematic review

1.1 Main aspects of research

The study of linguistics applied to the field of computer science is a much-discussed topic today. In this field, the software localization process is relevant. It describes the linguistic and cultural adaptation of an IT product to a specific market scenario. In particular, this research is related to the localization process in video games.

The IT product localization sector is in a phase of strong development due to the high market demand, especially now that the computer is taking on a human connotation due to the way it interacts with the user. On the other hand, a specialized professional is not easy to find, as it requires skills in both IT and linguistic, as well as intercultural areas.

The aim of this chapter is to provide an overview of the main software localization methods currently in use, and to identify the main issues and challenges associated with them. In addition, the main linguistic and cultural aspects of video games will be examined.

1.1.1 Software and game localization

The localization industry grew out of the computer industry in the 1980s, despite the growing demand for multilingual support in digital products. As the global market demands fully customized programs that include non-linear text and multimedia content, the simple translation process would not be enough. (Esselink, 2000).

Moreover, considering that the localization of digital products is directly related to the demand of the software and video games industry, it is in constant evolution due to the fact that new digital productions are developed and need to be localized. In this scenario, new aspects of translation studies are being defined in relation to localization practices, requiring further research in this area.

In *A Practical Guide to Localization*, localization is defined as the process of linguistically and culturally adapting software to make it suitable for a target market. (Esselink, 2000). In

addition, Fry & Lommel (2003) described localization as the process of adapting digital software to the specific needs of particular cultural scenarios. Among the various kinds of software, video games are related to localization processes. In particular, *Game localization* is defined by Chandler & O'Malley (2012) as the process of translating a game's text into other languages, meaning that the game localization process includes the translation of linguistic content and other non-translation activities.

O'Hagan (2015) defines game localization as a series of phases involved in adapting video games technically, linguistically, and culturally to a target market with the goal of distributing them in areas other than their countries of origin. In this complex process, translation appears in only two of the fourteen steps described.

From the definitions discussed above, it is clear that game localization involves more than just translating the language assets.

Game localization can thus be considered as a new industry that emerged as a result of the birth of video games.

In the 1990s, game publishers began to move toward "partial localization" of games, in which the text in games, such as the user interface (UI) and on-screen subtitles, is translated. Bernal-Merino (2011) describe three specific levels of localization: "partial localization," "full localization," and "deep localization."

Today, software and game developers are constantly trying to deliver fully localized products in target cultural scenarios, where the product selected for "full localization" will include in-game text translation as well as localized in-game audio. In other words, game developers and publishers are increasingly identifying new aspects of the game that can be adapted to increase player immersion and engagement (Teo, 2017).

Game localization is commonly associated with software localization, in particular due to the common aspects present in both games and software. In fact, digital products such as video games are generally classified as entertainment software, and therefore the user interface in games needs to be localized in the same way other software.

Both localization processes then include language translation and software integration. (O'Hagan & Mangiron, 2006). In a similar way, "the goal of game and software localization is to deliver a product that is ready for release in the target markets" (Teo, 2017, p. 8).

In addition, there are also significant differences between software and game localization. In fact, if software localization is mainly concerned on the functionality of the product, game localization should provide an equivalent user experience in target cultural scenarios, and this usually needs a significant level of creativity in localization tasks. (O'Hagan & Mangiron, 2006).

In addition, "the standardization of localization practices for software localization does not always apply to game localization. Games can be categorized into broad genres, such as role-playing game (RPG), first-person shooter (FPS), massively multiplayer online role-playing game (MMORPG), real-time strategy (RTS), simulation, action, sports, racing, and so on" (Teo, 2017, p.9). This may require different localization approaches for each genre.

In an opposite way to localization of application software, video game localization would be often related with audiovisual translation (AVT); in fact, audiovisual content requires to be dubbed or subtitled (O'Hagan & Mangiron, 2006). Even though there are similarities in practices between audiovisual translation and game localization, most of the methods used in AVT are not always possible in video game localization. In fact, some elements such as subtitles in games are often displayed at a faster speed than in movies, without taking into account the average reading speed of people. In addition, restrictions on the number of characters allowed per line and the total number of lines of captions allowed on the screen are generally not present in video games. In addition to closed captioning, other elements present in video games, such as UI text, system text, and error messages, may coexist with closed captioning on the screen. Moreover, variables related to individual player performance and profiles are often found in textual content of games, due their interactive nature. (Bernal-Merino, 2007).

Then there are two different aspects to the localization process for video games. "Localization includes both 'linguistic' localization (the process of translating languages) and 'product' localization (related to the art assets and background music in the game)." (Teo, 2017, p10).

As the main goal of the research is to discuss the aspects of translation in video game localization, the study will focus on "linguistic" localization by addressing the language

translation process in relationship with Translation Studies. In other words, it examines the process of translating the textual content of games to make them appropriate and enjoyable in target cultural scenarios. The localization of other multimedia elements, such as sounds and pictures (which are outside the scope of Translation Studies) will be mentioned as part of Game Studies.

1.1.2 Existing research and gaps

The existing studies on game localization can be approached from different perspectives. In fact, there have been attempts at describing the whole localization process from the perspective of industry practitioners and academia (Bernal-Merino, 2014). While these studies provide a good foundation for understanding the localization process, the development of new dimensions in games means that the information needs to be constantly updated to keep up with technological advances.

Moreover, existing studies were focused on the linguistic approaches related to video game localization with specific case study analysis (O'Hagan & Mangiron, 2006). In this context, the researches stated that an important aspect of video game localization is to offer an enjoyable gameplay experience. As a result, video game localizers focus on specific methodologies and approaches to deliver the best possible gameplay experience to players.

To do this, localizers use a range of common translation strategies (i.e., literal translation, domestication) and new strategies (i.e., transcreation) adapted to the creative needs of game localization. The preference for "domestication approach is even more apparent in game localization when jokes, puns, plays on words are involved, which is often coupled with the translation strategy of adaptation" (O'Hagan & Mangiron, 2006).

Specific issues in the domain of game localization are highlighted and the need for specialized courses for establishing translator competence is explained in existing studies. In fact, the approaches and decision-making processes in game localization to deliver the desired player experience are the main focus in earlier research. However, a new line of investigation, in the

form of understanding players' perception of games across different cultures, is gradually attracting researchers (O'Hagan, 2009).

The gameplay experience is only one of many indicators of localization quality, although it is important for localization practitioners to know the opinions of game end users. In particular, understanding the gaps between the expected outcomes of localization and the actual experiences of players will be useful in establishing practices in the localization industry.

Adaptation of video games across cultures was investigated to gain greater insights into the role of culture in game localization (O'Hagan, 2009). Despite the *skopos* of game localization, there is no a standard approach or technique for cross-cultural transfer, as several factors, such as games hybridization, multidimensionality and games, represent part of an entertainment ecosystem, which is basically complex.

Also, there are no significant studies involving the relationship between the linguist and the programmer, especially related to cross-cultural adaptation of videogames in order to define peculiar skills for new and existing professional figures. Moreover, even *crossmediality* and *transmediality* represent cardinal narrative aspects to take into account in both internationalization and localization stages of modern games.

Although the video game industry has surpassed the movie industry in terms of revenue, research in this area is relatively scarce. In fact, the field of translation is not properly assessed in game studies, while video games remain similarly understudied in translation studies (O'Hagan, 2013; Teo, 2017).

Therefore, given the rapid expansion of the video game industry, it is relevant to highlight this as a valuable area for research in translation studies (Teo, 2017).

This research aims to investigate from an interdisciplinary perspective the way a videogame could be ideated and designed starting from the idea of a storyline and how narration could be technically and culturally adapted to different scenarios.

Also, the study focuses on the ways media are related to games by analyzing their relationship with *convergence culture* theory (Jenkins, 2006).

1.2 Systematic literature review

This subsection reports on the main criteria used to select and properly use references for the main research objectives.

In particular, the *PRISMA* methodology (Page M.J., McKenzie JE et al., 2020) has been adopted. The reliability of this methodology has been largely proven and certified by almost all the scientific community, allowing to optimize the overall quality of reporting making the peer review process more efficient.

In the following paragraphs, all the steps leading to the selected references are reported. Specifically, the research methodology and related research questions will be described. Then, the selection study procedure with the related inclusion/exclusion criteria will be presented.

All of the results obtained, including the answer to the main research questions, will be analyzed and discussed in detail. Finally, a diagram of the results will be reported in Appendix A.

1.2.1 Research method

In this study, an evidence-based search and study selection process was used to achieve accurate results and improve transparency.

This systematic review process consists of the following steps: developing a review protocol; conducting a systematic review; analyzing the results.

The research has considered both indexed and not indexed works. In particular, the adopted research engines have been Web of Science and Scopus. Google Scholar has been used for not indexed references. In particular, the choice to add not indexed works was considered important for many reasons. First of all, this specific field of study is relatively new and many relevant studies are not indexed yet.

Also, these types of references often cover several specific aspects of this research, including some interesting case studies, viewpoints, and techniques that are very useful for the purpose of this thesis.

The main keyword combinations used to search relevant references in the three research engines are the following: “Software localization” OR “software localisation” OR “software localization issues” AND “videogame localization”; “software translation tools” AND “software localization challenges” AND “software localization case studies” NOT “localizer”.

This search was made on 19/12/2021, and the total number of obtained results was 386.

These keywords were meant to answer at the questions upon which this work is based; these questions will be presented on the next section.

Finally, given that the chosen field of study is constantly evolving, a qualitative analysis would also be integrated. In this direction, a focus group will be conducted with the participation of both academic and professional profiles of experts in software and game localization. The focus group would be used to validate the research questions, by allowing also to retrieve updated information, included any eventual further issues/challenges.

1.2.2 Research questions

The main questions upon which the meta-analysis is developed are the following:

1) What are the current ways of proceeding in software localization?
2) What are the main issues in software and videogame localization?
3) What are the main open challenges in videogames localization?
4) What are the main studies in comparative linguistic and culture related to videogames localization?

The idea behind these questions is to follow a step-by-step approach to find out, first of all, what is the most common way to operate in localization process, and which are the main techniques adopted; here, is of particular importance to define and compare the main features of these techniques/methodologies, identifying which are the most efficient ones.

Another important point is to recognize the main issues in software localization procedure. In fact, this complex process always involves both technical and human aspects. The focus here is on an in-depth analysis of the relationship between the linguist and the programmer in order to identify the main problems that can lead to a poorly localized product.

The next step would be specific to entertainment software, with the aim of identifying the main open challenges to solve some of the current big issues in video game localization, and trying to contribute with the creation of useful strategies and solutions.

Finally, this research would highlight the most important comparative linguistic studies/case studies in video game text translation and localization. In particular, the main priority here would be to make an analysis of how certain terms and sentences are translated from the source language to the target language.

In order to obtain useful data, a review and analysis of parallel corpora would be conducted. Also, an overview of low-resource languages would be important to fully understand further issues and challenges to be investigated.

1.2.3 Study selection procedure and inclusion/exclusion criteria

In order to select the most accurate results for this research, the following indicators (and associated descriptors) were used:

Table 1.1 Score indicators for references.

Availability (0-1 points)	**Relevance (0-5 points)**
0 points: references are not available	A score of 0 points was associated with off topic results.
	A low score (1-2 points) was associated with results that do not meet the main focus of the research, or appear to be too generic.
1 point: references are available	A medium score (3 points) was associated with results that appeared coherent with the main topics of the research. These results matched with one or more research question's general themes.
	A high score (4-5 points) was associated with results deeply related to research question's specific themes, even proposing important and useful case studies.

The study selection process was based on two main indicators: availability and relevance. Each indicator has two or more descriptors associated with a scoring system.

In addition, a time indicator filter was not used because this field of study is relatively new and barely covers the last two decades.

In this research, only results that were available in their complete form were selected. This choice was obviously made in order to be able to easily consult any part of the references. The availability indicator is binary and all selected results received a score of 1.

As previously showed, the relevance indicator is built around four score areas (see Table 1.1). In addition, the relevance indicator has specific inclusion/exclusion criteria. Only studies with a score of 3 or more were selected. This selection was made to include only certain papers and to exclude those that could not answer, even partially, at least one of the four research questions.

1.3 Meta-analysis of results

In the following subsections will be performed the meta-analysis of the results obtained through the study selection procedure.

1.3.1 General findings

The systematic review reported 35 indexed results and other 10 which are not indexed, for a total of 45 selected results.

The diagram showed in Figure 1.1, which is an adaptation of the official *PRISMA 2020 flow diagram,* reports in detail the whole procedure of this selection.

Moreover, the review shows how the majority of the related indexed studies were mostly published on the last decade. The diagram in Figure 2.1 shows the trend in detail.

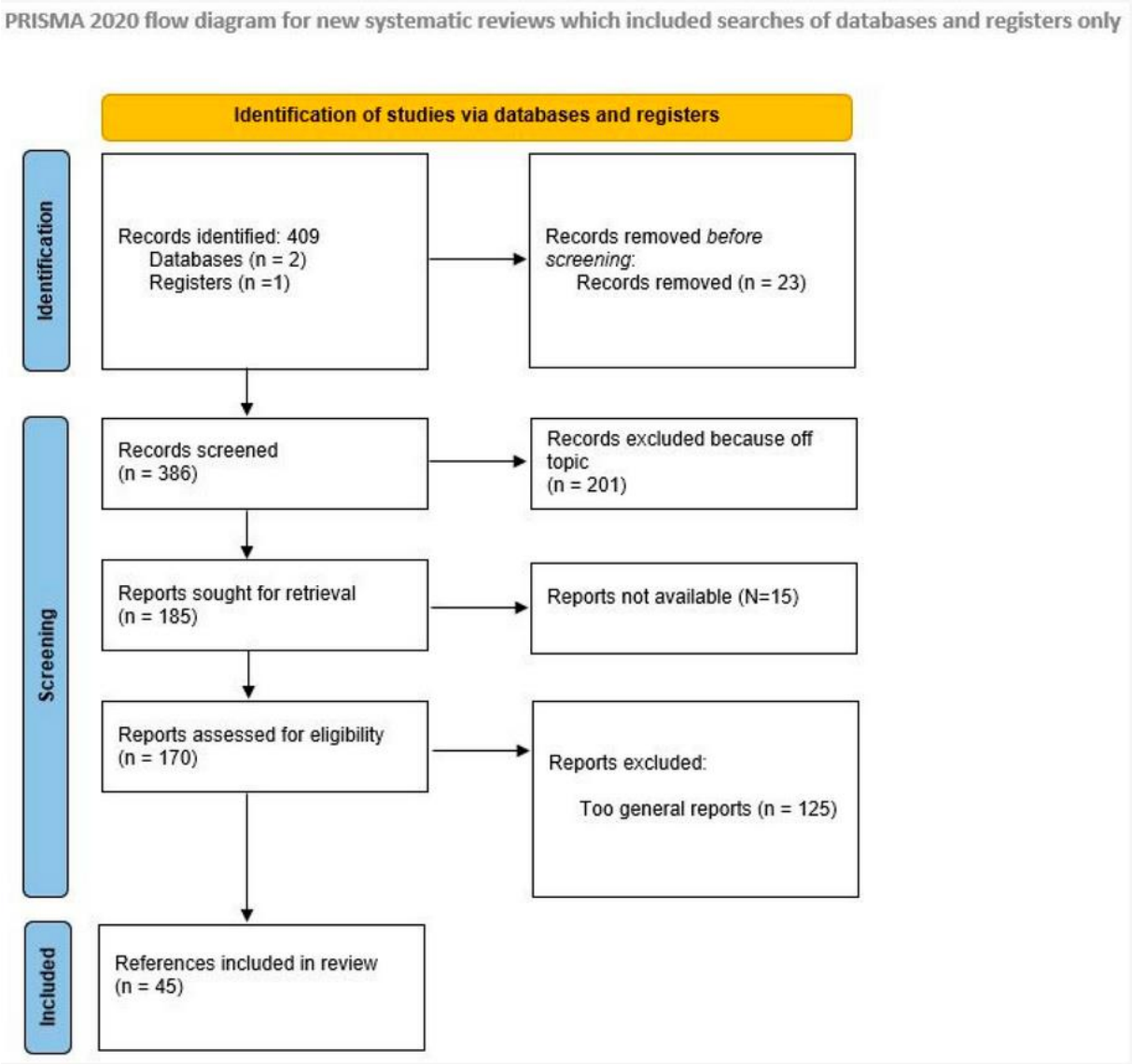

Figure 1.1 PRISMA flow diagram adapted to the study, from Page et al., 2021.

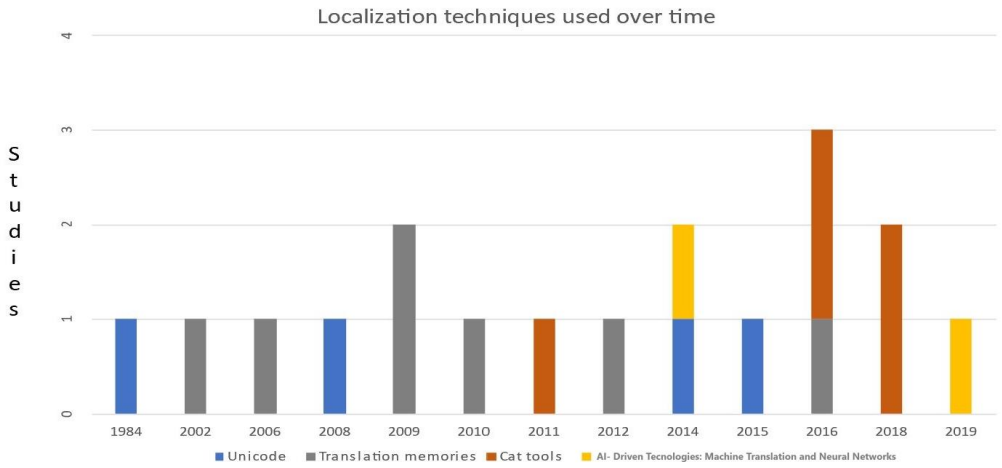

Figure 2.1 Trend of studies. Source: provided by the Author.

Also, Figure 3.1 shows in detail the publishing channels of the selected studies.

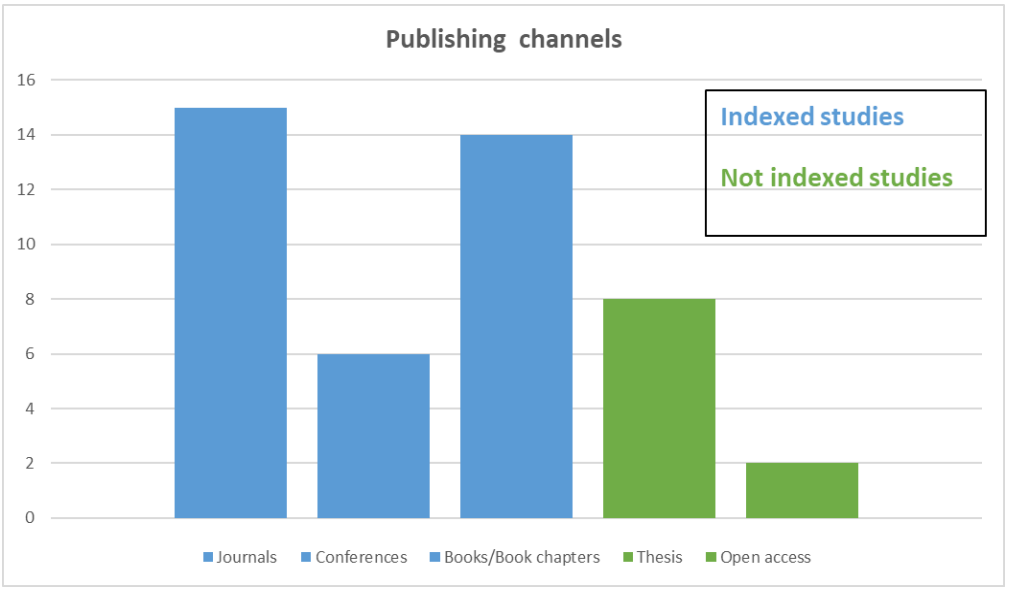

Figure 3.1 Publishing channels. Source: provided by the Author.

The selected publications were generally published in journals (33%-15 studies), followed by books/book chapters (31%-14 studies), dissertations (18%-8 studies), conference proceedings (13%-6 studies), and only 2 preprints (4%). Thus, 22% of the studies are gray literature

(dissertations and preprints), while the majority of research products (78%) are indexed in journals, books, or conference proceedings.

The first point that emerged is about software localization methodologies. In particular, the literature analysis shows that the most commonly used techniques are translation memories, Unicode, and computer-assisted translation tools (CAT tools). Less commonly used methods are those based on artificial intelligence, mainly machine translation and neural networks.

In particular, translation memories seem to be the most widely adopted solution, while CAT tools would have more future-proof features as they use newer technologies.

However, the results obtained need to be contextualized on a time-proportional basis. Although these results may suggest that AI-based tools have little role to play in the localization industry, AI technologies are brand-new tools that implement innovative and relevant tools related to linguistic localization.

With this variety of solutions, a common problem seems to be related to the internationalization process; in fact, most internationalized products do not properly support certain localization tools. A major challenge would be to standardize internationalization processes, which would also allow to reduce localization costs.

Another issue is related to *under-resourced* languages and cultures, or even specific ones like Arabic and Japanese. Here, localization tools struggle to support these languages, which also have particular and unique symbols and characters. In this regard, some of the results obtained propose comparative linguistic studies between different languages, with the aim of improving the way in which certain terms can be translated and how the internationalization process can be adapted to them.

Many other works reported specific studies related to the localization of video games. These studies focus on different aspects such as narrative, semiotic, economic, artistic and socio-cultural.

In particular, the topics of greatest interest are about non-linear storytelling (even related with arts and game design strategies), cognitive semantics, industrial strategies, *transmedial narration* and *convergence culture* (Jenkins, 2006).

There are also several case studies analyzing localization in specific games. The video games examined are both AAA titles and open source/abandonware; in the latter case, amateur localization, essentially done "for fans by fans", is relevant (an interesting example here is the case of *romshacking*).

Most of these works outline a major problem: the lack of multidisciplinary skills shown by both programmers and linguists. This problem often has a negative impact on the final quality of the products.

The most challenging solution would be to reduce the gap between these two professionals by redefining the way they work together.

Finally, an integrated approach between academic and professional fields seems to be necessary, also in order to propose (in the future) standardized educational pathways.

The following sections discuss each research question in the context of the meta-analysis results.

1.3.2 What are the current ways to proceed in software localization?

As mentioned in the previous paragraph, there is still not a standard way to proceed in software localization. In this regard, Figure 4.1 reports the main localization techniques currently used.

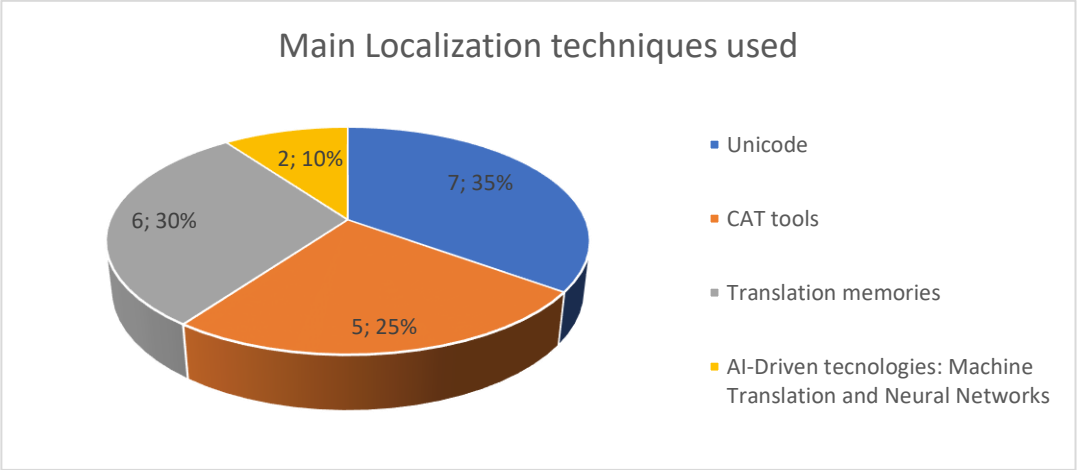

Figure 4.1 Main localization techniques used. Source: provided by the Author.

It is important to note that the idea of being able to achieve a quality translation fully automated has given way, in recent years, to a change of perspective: computers do not provide translations, but an aid to translation; in fact, this aid can be more or less accurate and efficient depending on the context, available techniques, etc. Studies talk about *computer aided translation*, and no more about automatic translation. The translation carried out entirely by the computer and the one carried out by a human being without the slightest help of a computer, are only the two abstract extreme points of a continuum where all are possible several concrete cases of interaction and collaboration between man and machine.

It's important to note that in localization, the linguistic and technical aspects are interdependent: in a localized program, it's necessary to guarantee both comprehensibility and clarity, as well as correct functioning in the target market. (Di Pofi, 2002).

Also, the idea of localization related to a particular software can happen in the context of two quite different scenarios.

In the first scenario, localization represents a goal that the person sets for himself to develop a specific program, with the interest of facilitating its use in different cultures and with different languages. In this scenario, the focus is on the program: the programmer internationalizes the software and looks for people who can localize it into different languages.

In the second scenario, however, the focus is on the language: where a software developer would be interested in adapting a preexistent working environment (for example, an operating system with its most important applications) on a particular language. This affects how localization takes place. For example, in the first scenario, it might be easier to work with the programmers involved, while in the second scenario, where terminology tends to be more precise, it might be easier to ensure greater consistency.

All of this is related to choosing the best methodology/technique to use for efficient localization work.

1.3.3 What are the main issues in software and game localization?

The major issue than can affect the localization process are complex and varied, as summarized in Table 2.1.

Table 2.1 Major issues in localization

Studies	Issues
(Sajna, 2016)	Gap between internationalization and localization
(Sviridova & Fadyeyeva, 2009); (Yao, 2010)	Localization costs and time constraint
(Pinnis et al., 2014); (Soh, 2018); (Tomar & Bhatia, 2015)	Lack of support for *under-resouced languages*
(Estrella et al., 2019)	Lack of information available for translators
(Lepre, 2015); (Pettini, 2021)	Fragmentation of *nonlinear storytelling*

The issues mainly happen because of the lack of standardized methods and techniques adopted to localize a software.

These methods and techniques must be supported by the internationalization process, which refers specifically to the design and development of a product, application, or document content so that it can be localized for target audiences that vary by culture, region, or language.

Then, the first issues that came out are related to the interaction between internationalization and localization processes, which are both not standardized (Sajna, 2016). In fact, the internationalization process often struggles to properly support the different methodologies used in localization. (Toftedahl, 2020).

This leads to another issue, which is related to localization costs (Sviridova & Fadyeyeva, 2009; Yao, 2010). Localization has significant costs, and the expertise required may not be available in all cases.

While translation software and careful preparation of the source text minimize the cost of translation, there is still a need for human intervention to handle words, especially technical terms for which there is no word in some languages, as well as differences in meaning from direct translations and cultural differences. (Caschera et al., 2013).

In addition to this, another big issue is about *under-resourced languages.* These languages (such as Czech, Estonian, Hungarian, Latvian, Lithuanian and Polish) do not have much software/data/tools/resources available for computer-aided translation or machine translation, or more specialized resources. (Tomar& Bhatia, 2014). They also have peculiar text characters that differ significantly from the most common ones used in the world. Thus, due to the lack of tools to implement them, both internationalization and localization phases would be more articulated and complex for these languages and cultures. (Soh, 2018).

Even considering building “usable machine translation systems for less-resourced languages with complex morphology and syntax is difficult due to the lack of linguistic resources on the one hand, and the complexity of the language on the other” (Pinnis et al., 2014, p. 209).

In addition, there are issues specific to the field of entertainment software. In fact, while the translation process in games can be associated with audiovisual translation and application software localization, it also possesses individual features (Bernal-Merino, 2007), so there are some specific problems that videogame translators may encounter. In this regard, "a relevant one is time constraints; in fact, video game developers often work under tight deadlines, which may leave less time for translators to work on a game". (Girona, 2018, p. 4).

In addition, localizers often do not have enough information about the projects they are working on; in fact, they usually work without the full version of the game, which can lead to translation errors due to this lack of contextual knowledge. (Girona, 2018). Chandler (2014) explores this concept, suggesting that localizers should have access to all information related to playable versions of the game and other documentation, such as voiceover casting notes, glossaries, file format information, and any other tool that can help localizers in their work. (Chandler, 2014; Girona, 2018). These would be crucial aspects, for example, to have a better understanding of a character's personality and other important elements, leading to a higher quality translation.

Then, there is a large variety of videogame genres within the videogame industry, such as *First-Person Shooters, Role-Playing Games, Puzzle games, Adventure games, Simulation games* etc. These types of games may require translators to research information about the context in which they are set, in order to become familiar with its vocabulary and style; this can include reading books or watching movies set in the game contexts or themes.

Finally, another issue is text fragmentation itself in *nonlinear storytelling.* (Lepre, 2015) (Pettini, 2021). In fact, in several products, "the story depends on the player, since most events in a game only happen when the player triggers them. As a result, translators can use tables and spreadsheets to organize multiple, non-linear strips of text. However, this can be difficult due to the lack of context and chronological order, so translators who are used to translating novels or other media may have some problems with these situations. In addition, because video games are made up of programming code, the actual text needs to be extracted from the cryptic language and presented to translators so they can do their job efficiently." (Girona, 2018, p. 7).

All this leads to the fact that it can be difficult to find linguists and translators capable to work efficiently within this large variety of scenarios. Especially also because there is still not a clear definition of all the skills required.

1.3.4 What are the main open challenges in game localization?

The main challenge in video game (and software) localization is to define the right skills for translators and to adapt the curriculum to include additional competencies that bridge the gap between the classroom and emerging industry practices (Ressin et al., 2011). The systematic review identified several open challenges aimed at improving the final quality of localized products.

Table 3.1 shows four crucial open challenges to face in order to improve and to make videogames and software localization more efficient.

Table 3.1 Open challenges in video game and software localization.

Studies	Challenges
(Kingscott, 2002); (Bernal-Merino, 2015); (Dagiene & Jevsikova, 2009); (Estrella et al., 2019); (Rodríguez-Castro, 2018)	Defining proper skills for translators
(Dos Santos & Oliveira, 2017); (Budin, 2006); (Ressin et al., 2011); (Sajna, 2016)	Enhancing relationships between translators and programmers
(Estrella et al., 2019)	Keeping translators informed about the context of the game
(Dos Santos & Oliveira, 2017); (Budin, 2006); (Saha, 2008)	Improving internationalization software
(Heyn, 2016); (Karkaletsis et al., 1995); (Kingscott, 2002); (Muntés-Mulero et al., 2012); (O'Brien, 2016); (Ranta, 2009) (Wakabayashi, 2016); (Wang et al., 2019); (Wilson & Shaw, 1984)	Improving CAT tools, machine learning translation and other localization techniques

In this regard, software companies need to find a way to create the best possible collaboration between the translator and the programmer. A first step would be to involve the translator directly in the internationalization process. (Estrella et al., 2019). It is also important to inform the translator about the proper context of the game, giving him all the information about the story, the main characters and the environment on which the game would be developed. (Gnoffo & Pirrone, 2023).

Then, video game localization requires that the translated content be displayed correctly on the screen. In fact, some languages use more words or longer words for the same concepts when compared to English (Gnoffo & Pirrone, 2023). This is where internationalization software needs to be adapted to support the correct number of characters that need to appear on the screen, as well as calculating how the texts can increase or decrease in size when switching from one language to another. This often occurs even with the most common western languages, so it is important to find a general solution involving also *under-resourced languages*. This would improve the readability of both *in game texts* and *UI texts*.

Moreover, in order to make a videogame usable for customers in different regions, it's not enough to simply translate the text. In fact, translators have to deal with differences in formatting and conventions for writing dates, times, numbers, addresses and currency. It is therefore important to include all these aspects in the internationalization phase so that the translator can easily adapt them to the target country/culture. (Pirrone & D'Ulizia, 2023; Gnoffo & Pirrone, 2023).

Then, to fix bugs or add new features, most game versions receive regular updates. Often these updates include elements that need to be localized. This leads to a process of "continuous localization" with a large number of small localization changes that require continuous adaptation. To effectively manage this demand, translation technologies would need to facilitate this type of adaptation.

Finally, other important open challenges are related to improving some of the newer technologies, such as *CAT tools* and *machine learning*translation. (Heyn, 2016; Muntés-Mulero et al., 2012; Wang et al., 2019).

In particular, since these techniques are relatively new, they undoubtedly will be empowered with new features in the next years (Ranta, 2009; Wakabayashi, 2016). In particular, *CAT tools* appear to be one of the best ways to adapt localization with internationalization phase. In addition, improving machine learning algorithms would provide even better prospects for software and game localization. (Gnoffo & Pirrone, 2023).

1.3.5 What are the main studies in comparative linguistic and culture related to game localization?

Localized video games would not be fully enjoyable to play if they used literal translations. While literal translation has its place in certain fields, videogames are not part of them.

Rather than simply translating individual words or phrases, the localization process allows translators to transfer the meaning and purpose of the source content into their own creations. The goal of localization is to effectively scrap the original and insert specific text that will evoke nearly the same emotions and responses in players as the original.

In this systematic review, three particular case studies on comparative linguistics related to video game localization and corpora were reported. Table 4.1 shows them with their specific description.

Table 4.1 Comparative linguistic studies.

Studies	Description
(Almeida & Pastor, 2015)	Categorization of the values of seem in a parallel corpus of technical texts (English and Spanish)
(Mendiluce-Cabrera & Bermúdez-Bausela, 2006)	The paper discusses the presence or absence of diatopic variants in sci-tech written language
(Lepre, 2015)	Parallel corpus analysis of two videogames

By comparing old and new translations through *parallel corpora*, the studies aim to see if and how translation choices have changed over time. (Lepre, 2015) (Almeida, 2015; Pastor, 2015).

In particular*, parallel corpora* occur when texts are available for two or more languages which are systematically the translation of each other.

The studies also reported on how various audiovisual features of games can affect localization by examining popular games.

Also, the studies focus mainly on written language, even including specific communicative aspects, such as irony in video game dialogues.

Finally, the selected works are also related to a particular form of communication, known as *Sci-tech communication*. (Mendiluce-Cabrera & Bermúdez-Bausela, 2006). This represent a sub-code proper of ICT environment, where translation is a key issue; as science and technology attempt to unify very different linguistic communities and cultures under one single language, non-native users of that language need a translation both for terms and neologism with related new cultural aspects (D'Ulizia et al., 2020).

1.4 Qualitative analysis

As mentioned in the methodology section, a qualitative analysis has been adopted to properly support the *PRISMA* approach.

As the field of software and game localization is constantly evolving, a hybrid research methodology that integrates both quantitative and qualitative analysis is used to improve the reliability of results by providing updated feedback on research questions.

The focus group was conducted with the participation of 3 academic profiles working in the fields of application software localization, website localization and game localization. In particular, the focus group participants have specific and varied academic and professional expertise:

- Participant A is a renowned scholar in the fields of translation studies and game localization and has made significant contributions to the academic and practical understanding of video game translation and accessibility. His research focuses on audiovisual translation, accessibility in media, and the intersection of technology and translation. He also has several years of professional experience as a localizer in the video game industry.
- Participant B is a prominent figure in the field of audiovisual translation, particularly in the localization of websites and web-based applications. He has contributed

extensively to both academic studies and practical applications of the localization of digital products, publishing numerous articles and research papers on the subject. His work often explores the challenges of adapting content for different types of users.

- Participant C is particularly known for his work in translation theory and professional practice related to application software localization. His research includes numerous publications focusing on the evolving role of translators and localizers in a globalized world and the interplay between technology and translation. His contributions to academic discourse and active participation in conferences and research projects have made him a key figure in the development of translation studies.

1.4.1 Focus group structure

The focus group entitled "Software and videogame localization: methods, tools and perspectives" was conducted online on November 8, 2022. The platform used was *Microsoft Teams*, and the total length of the event was 1 hour and 15 minutes. In addition, the entire conversation was recorded with the consent of the participants.

The purpose of the focus group is to explore findings on the status quo of linguistic and cultural adaptation of software and video games, localization techniques already in use (CAT tools, machine learning), non-linear/interactive storytelling applied to video games, and the relationship between the translator/localizer and the programmer in software and video game development.

Some of these results have been obtained through a systematic literature review using the PRISMA methodology. The purpose of this focus group is to gather further information.

The focus group consisted of 8 questions divided into 3 thematic areas. The complete dataset of questions and themes is reported in Table 5.1 below.

Table 5.1 Focus group thematic areas.

AREA 1: Education, skills and competences of software and videogame translator/localizer.	**AREA 2: Linguistic phenomena and socio-semiotic aspects in software and game localization.**	**AREA 3: Issues and open challenges in software and game localization.**
What kind of skills would be required to new and existing professional figures in the area of translation and localization? How do you think education systems can meet the needs of these sector of the market?	How linguistic phenomena, such us loanwords and calques would affect the software and videogame localization processes?	Do you think that automatic translation (especially through machine learning) is becoming relevant in the field of software and game localization? If yes, do you think that the translator would take the role of supervisor (or quality checker) over the machine results?
How do you think would be possible to have a better cooperation between programmers and translators?	Do you think low-resourced languages would be better supported in the future of software localization?	How do you think the relationship between movies and videogames would evolve in the future?
	Do you think *crossmediality* and *transmedia* represent cardinal narrative aspects to take into account in both internationalization and localization stages?	Can you tell us something about the most common issues about translation / localization related with interactive storytelling?

For each question, an answer was given by all the participants. Also, at the end of the event, the online platform adopted automatically produced a textual transcription of the focus group, through a *.docx* file.

1.4.2 Information extraction methodology

In order to extract all the relevant information related to each area, a qualitative data analysis software has been used. The selected software was *Atlas.ti* (https://atlasti.com/), which offered several useful tools to properly analyze the focus group transcription file.

The data analysis and extraction process consisted of several steps, which are described below.

Since the automatically generated transcription file contained many repetitions and typing errors, the first step consisted of a manual cleaning phase to reduce them. Then, the text was codified in its substantive aspects, each of them related to a specific thematic area.

In addition, several specific keywords and text passages were searched and coded for use in a co-occurrence analysis, with the primary purpose of showing which items (such as issues/challenges and other relevant aspects) could be associated with the research questions.

For each area, a Sankey diagram showed the specific elements produced by the analysis, and related to the main topic.

All the obtained results will be discussed as integration of *PRISMA* meta-analysis.

1.4.3 Qualitative analysis results

As mentioned in previous subsections, the qualitative analysis results have been divided in three thematic areas.

The results related to the first area (Education, skills and competences of software and videogame translator/localizer) reported some relevant aspects in the development of localizer professional profiles, as showed in Figure 5.1.

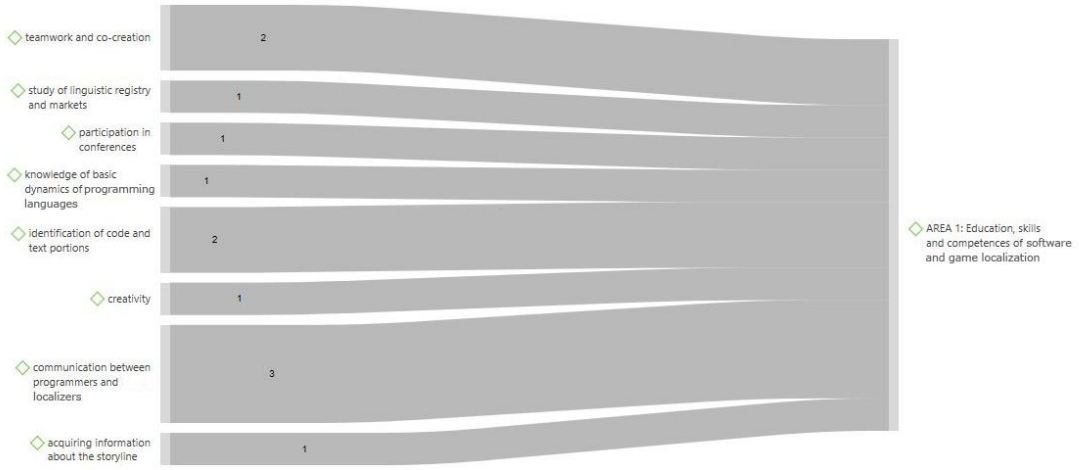

Figure 5.1 Area 1. Education, skills and competences of software and videogame translator/localizer. Source: provided by the Author.

In particular, the importance of efficient communication between programmers and localizers can be noted. (Budin, 2006; Dos Santos, 2017; Oliveira, 2017; Ressin et al., 2011; Sajna, 2016). Localizers also need to understand the basic dynamics of programming languages, with the ultimate purpose of being able to differentiate text parts by code.

Another relevant skill to acquire would be a proper use of creativity, especially in a shared working environment, other than a regular participation to specific conferences to keeping up to date about the latest trends and methodologies (Pettini, 2021).

The results related to the second area were focused about linguistic phenomena and socio-semiotic aspects in software and game localization.

Figure 6.1 shows all the results in detail.

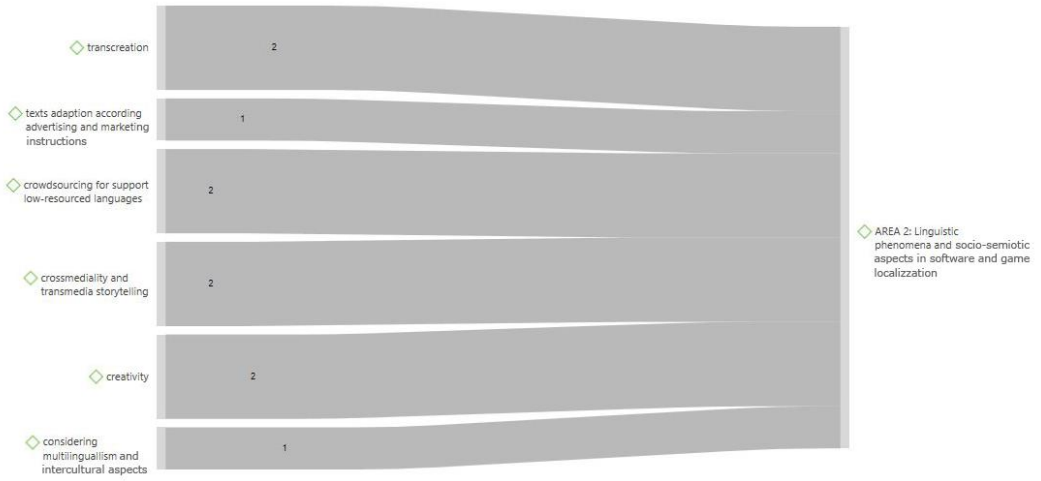

Figure 6.1 Linguistic phenomena and socio-semiotic aspects in software and game localization. Source: provided by the Author.

In this specific case, the analysis reported several aspects that are deeply involved in the localization processes. In this context, creativity is linked to the concept of transcreation, in order to better adapt textual and audio content to a specific cultural scenario. (Pettini, 2021; Gnoffo & Pirrone, 2023).

Moreover, *crossmediality* and *transmedia storytelling* represent two further aspects to consider in software and game localization, as they are often linked to other medial forms and channels. Furthermore, the importance of properly supporting under-resourced languages has been mentioned by participants, who underscored crowdsourcing campaigns as a possible solution. In this case, the involvement of native translators is necessary, as the use of CAT tools and machine translation technologies related to under-resourced languages can lead to localization issues caused by missing characters and errors in translation tags (Pinnis, 2014; Vasiljevs, 2014).

Finally, the importance of properly supporting under-resourced languages was reported. A possible solution in this regard would be crowdfunding campaigns.

The results related to the third area outline the main issues and challenges in software and game localization, as shown in Figure 7.1.

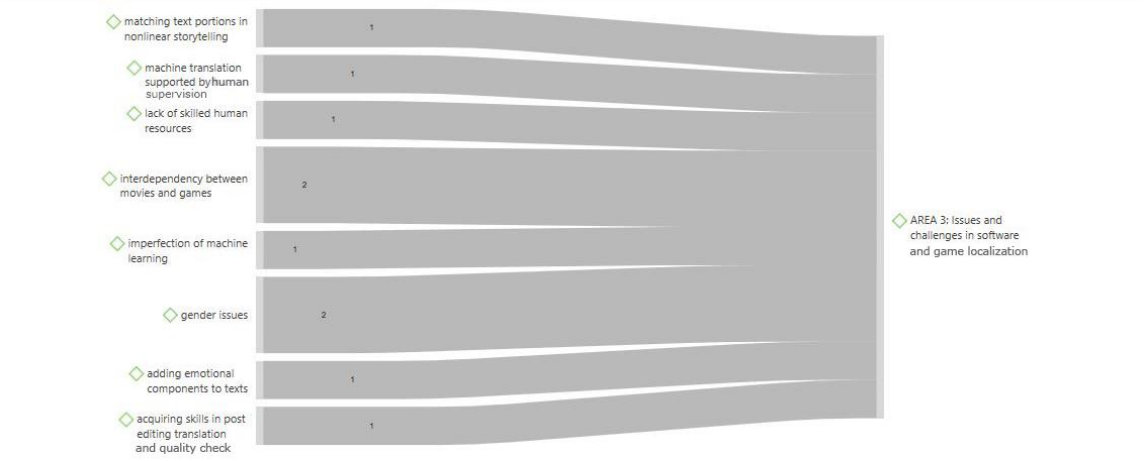

Figure 7.1 Major issues and challenges in software and game localization. Source: provided by the Author.

In this scenario, some relevant issues are focused about the lack of skilled human resources and the difficulty in adapting and translating nonlinear text portions.

Localizers would also be able to acquire skills in post-editing translation, other than adding an emotional component to texts. (Dagiene, 2009; Jevsikova, 2009; Pettini, 2021). This confirms the need to define appropriate skills for translators and to include additional competencies in their curricula. (Bernal-Merino, 2014).

Moreover, results reported further important challenges, which are specific of our times.

The first important aspect in this direction is gender; in particular, since localizers often work with non-linear texts, they need to consider building stories or user interfaces around the user profile.

In conclusion, the second aspect is linked to the interdependency between movies and games; in fact, nowadays games tend to offer stories and experiences similar to films. Counter wise, movies are implementing interactive features, often related to new storytelling methodologies, such as branching narrative.

Discussion

The aim of this chapter was to examine the environment and techniques of software localization through specific research questions in order to find a gap in the field of study. This subsection focuses on discussing the results of the systematic review in order to find a starting point for research.

While the localization process can be compared to simple translation, it is actually different for a number of reasons.

First of all, in order to implement the localization process, the software must be specifically "enabled" for it, in other words, it must be "internationalized". For example, while it is technically possible to translate a novel without the involvement of the author, this is not the case for software localization, which requires the collaboration of the programmer/developer and the translator.

Then, the localization process takes place in specific technological contexts: it follows that the translator must know, at least in principle, how the infrastructure that allows the operation of localized versions of programs in different linguistic and cultural contexts (known as *local*) works; and, to ensure the proper functioning of the localization produced by him, he must use some specific programs that allow checking what is written (first with the control of some characteristics of the texts, and then through procedures of compilation of source files).

It should not be forgotten that the programs are in continuous evolution, and therefore for its work the translator has to be in able to "recycle" the work already done for other locations, using peculiar localization tools that allow archives of recognizable and even reusable text segments.

In addition, since localization is not limited to translation, there may be technical needs related to many types of issues (i.e., font size, icons, colors, etc.).

Thus, the localization work must be carried out within a linguistic and cultural context: in particular, the translator must try to maintain, as far as possible, a certain stylistic and lexical coherence, both for the individual application and for the entire user interface with which the

end user will have to deal. (Gnoffo & Pirrone, 2023). This is why localization projects typically begin with the definition of glossaries and style guides.

Then, in video games, translators have to deal with the programming source code and with production costs.

As for the main related linguistic aspects, studies reported some peculiarities of a particular sub-code proper of information technology.

It is well known how numerous neologisms can be found in it, reflecting the dizzying pace with which new technologies are presented on the market. In a diachronic perspective have been indicated how many of these were born in their original Anglo-American form, and how they affect Italian language.

From a synchronic perspective, the studies analyzed two classical typologies of linguistic interference (*loanwords* and *calques*), highlighting how often there are motivations that can be shared, or at least understandable, from one point of view pragmatic, due to the choices made by speakers.

With regard to the scenario described, the systematic review revealed a gap in the studies; in fact, there are no relevant works that aim to define the skills and competences that should be acquired by the modern translator, who should now be identified as a new and flexible professional figure.

There are also no studies aimed at defining specific educational pathways for software and game localization. Consequently, the aim of this work would be to reduce the research gap in order to contribute to a better definition of this new professional profile.

This will be made through a detailed discussion about the main localization tools/techniques, included the main linguistic and cultural aspects that must be taken into account for software and videogame localization. In this regard, the following two chapters of the thesis will be dedicated to discussing these issues.

A case study on video game localization will also be presented; in particular, an *open source* video game will be analyzed from the point of view of the localization process, taking into account the localization technique used.

Then, a linguistic and cultural analysis will be conducted, taking into account parallel corpora and any kind of fan-made modifications related to the language and gameplay.

Finally, the study would try to discuss specific skills and competencies for translators involved in software and game localization, and also try to define the basics for future educational pathways.

Chapter 2. Localization techniques and methodologies

Introduction

An important aspect of software internationalization and localization (which distinguishes it from translation) is the need to use specific tools.

In fact, professionals responsible for the internationalization of an application should adopt specific infrastructures that facilitate the entire localization process, while those in charge of the localization of digital products should make use of dedicated tools that would allow to properly set up linguistic configuration files.

This section introduces both internationalization and localization processes. In particular, the most common scenarios of the internationalization phase will be described, along with the main features and scenarios associated with them. Then, the localization process is presented, with its main steps and tools.

In this regard, the study would focus on the techniques reported in the systematic review and meta-analysis. Each of these methodologies (along with related issues and challenges) will be discussed in detail.

2.1 Internationalization

In the last decades there has been a growing interest in the question of translation, especially because of the expansion of the phenomenon of globalization, and also because of the development of semiotic interests and the use of IT technologies aimed at automating the translation process.

The work of those who "translate" and adapt digital products may seem simple and mechanical, but it is a complex and multifaceted process.

Compared to traditional translation, the difference lies not only in the level of complexity, but also in the interaction between those who create and develop software (or its documentation) and those who "translate" it, adapting it to a specific target language and culture.

These processes would ensure that the software can be technically adapted to support different languages (*internationalization*), and then rendered in a particular language and culture (*localization*).

In particular, internationalization describes the action performed to optimize a software to make it sensitive to localization (Giacomini, 2006).

Also, while internationalization is considered a process of generalization, localization represents a process of particularization (i.e., adaptation to specific countries, cultural scenarios, and markets, both from a linguistic and cultural point of view).

Another important aspect is that the internationalization and localization processes involve a large number of people with different levels of linguistic competence, for which one of the main issues is to ensure coordination and maintain a consistent style.

In addition, anyone involved in localization should have higher technical skills than traditional translators, since localization involves working with pieces of code, programming languages, resource definition files, documents with highlighted or formatted text, etc.

In technical literature, the English term internationalization is often reported as "*i18n*", where the number 18 refers to the number of characters between the first letter "i" and the final one "n".

Then, Internationalization, which has a purely technical content, cannot be confused with globalization, which is related with strategic business choices (for example in the technical field, but also financial, managerial or marketing) aimed at facilitating the localization activity (Lommel, 2003), also if sometimes the two terms are used interchangeably.

2.1.1 Internationalization and *locale*

Locale is a key concept in understanding how the internationalization process takes place. In particular, according to the definition of Wikipedia (2010), the locale is a "*set of parameters that defines the user's language, country and any special variant preferences that the user wants to see in their user interface"*.

The use of the locale was introduced in *C* language in 1990 in ISO / IEC 9899: 1990 and expanded in 1995.

This regard, six categories are defined in the standard:

- LC_CTYPE is related with the way in which characters are encoded and affects the way how uppercase letters are converted to lowercase and vice versa;
- LC_COLLATE refers to characters order;
- LC_MESSAGES is related to the language of all those messages which are displayed to the user;
- LC_MONETARY is related with the way in which monetary amounts are expressed (currency symbol, separation sign between integer and decimal part, etc.)
- LC_NUMERIC refers to numbers in general;
- LC_TIME is related to the way in which date and time are represented.

The concept of locale has been adopted in various standards related to different operating systems, such as Linux.

In addition, specific indicators would be associated with the locale in order to easily recognize each language and culture. For example, depending on the language used, it will be possible to have the following locale:

For example, *it* is a generic locale referring to the typical settings of Italian language. Then, *it_IT* is a generic locale referring to the typical settings of an Italian language user who also lives in Italy;

It can be possible to have several examples of locale based on this system:

- pt_PT (Portuguese / Portugal);
- gl_ES (Galego / Spain);
- es_ES (Spanish / Spain);
- fr_FR (French / France);
- pt_BR (Portuguese / Brazil);
- ro_RO (Romanian / Romania).

In particular, an internationalized program will behave differently depending on the preferences specified by the end user.

In general, the locale definitions used by different software companies are different and can cause compatibility problems.

2.1.2 Identification of languages and internationalization levels

However, the concept of locale should not be confused with *language markup*, better known as *language tagging*. (Alvestrand, 2001).

While the purpose of locale is to make a program showing its own user language interface with the preferred settings, labels are meant to clearly indicate in which language a certain content is expressed.

Also, it is important to talk about *levels of internationalization*. In particular, there are five levels of internationalization, identified by Mabel (2005), which refer to the linguistic aspects that can be observed in applications:

1. Support for a single language and a single local (for example, U.S. English);
2. Support of *the code page 1252* languages that use the *Microsoft 1252 encoding* (in particular, all the languages of western and northern Europe);
3. Support for all languages with left-to-right writing, including those based on Greek and Cyrillic characters (Russian or Serbian), or based on Latin characters from Central Eastern Europe (Slovenian, Czech, etc.);

4. Support for European and Eastern languages, which use ideograms and therefore pose problems both for the insertion methods, and with character encodings;
5. Additional support for right-to-left languages (such as Arabic), which presents peculiar features (for example, some Arabic characters are represented differently depending on their position in the word).

2.1.3 Internationalization variants

Depending on how internationalization is technically implemented, three different variants can be distinguished (Sun Microsystems, 2003):

- *Monolingual internationalization*, when the creation allows different localized versions of a product, each one localized version supports only a particular locale;
- *internationalization for multi localization*, when the process supports data processing for multiple locales, with the determination (at software's execution time), of the actual locale to use;
- *multilingualization*, when are allowed data processing and display of messages in different languages simultaneously, such as, for example, when mixing Arabic and Chinese in the same document, using a program with a user interface in Finnish.

2.1.4 Internationalization beyond the linguistic aspect

The first thing that usually comes to mind when talking about internationalization is the language aspect. While language is absolutely relevant, it is important to keep in mind that it does not solve the problem, and that internationalization issues can arise even when an application is intended to be used by people who speak the same language.

For example, Mabel (2004) mentions the following peculiar aspects:

- wide variety of currencies;
- different data formats;
- different ways to write the time (i.e. 16:51 or 4:51 pm);
- different ways to write names;
- different legislations;
- different key layouts on the keyboard (especially when using keys for navigation purposes);
- meaning of colors and icons in different cultures.

Moreover, internationalizing an application is anything but a simple task, and goes well beyond some particularly relevant technical aspects, such as outsourcing of strings, icons and graphics containing textual elements, specific "page encoding" of the characters and management of the text.

2.2 Localization

Localization is the process of translating and adapting a software product. The meaning of the term has been extended and now includes, in addition to the translation of the software itself, the translation of websites and, more generally, everything that completes a software product: online manuals, documentation in HTML format, etc. (Vinci, 2001).

According to the Localization Industry Standards Association (LISA), the localization represents "*the process of changing products or services that takes in taking into account the differences in the individual markets"*.

As seen before for internationalization, the term localization is often reported as *L10n*, where the number 10 refers to the number of characters between the initial letter and the final one.

2.2.1 Localization scenarios

Usually, the idea of the localization of a specific software can happen in the context of two different scenarios.

In the first scenario, localization is a goal for a specific software, with the interest of facilitating its use in different cultures and with different languages. In this scenario, the focus would be on the software: the programmer internationalizes the software and looks for human resources capable of localizing it in different languages.

In the second scenario, the focus would be on the language. In this case, the main objective will be to localize a specific working environment (for example, an operating system).

In particular, these groups would decide on which applications concentrate their efforts.

This affects the way the localization is done. For example, in the first scenario, might find it easier to work with the programmers involved, while in the second scenario, the situation might be different.

2.2.2 Categories and levels of localization

In localization, there is a clear interdependence between technical and linguistic aspects. In other words, there is a need to ensure that localized software is understandable and functions correctly in the target markets. (Di Pofi, 2002). Sasikumar and Hedge (2004), identify four categories of localization:

- localization for display (*display localization*), which allows rendering of the text through the preparation of software modules able to manage writing systems, other than the European alphabetic one (for example, some Indian scripts use a specific notation, so when adding a vowel to a consonant, the form of the consonant changes, and this adds a certain grade of complexity);
- *language localization*, which consists in localization of the user interface, so that all textual content (from menu items to technical documents) appear in the target language;
- *cultural localization*, which has to do with the use of icons, metaphors, conventions, etc.;
- *device localization*, which takes into account, for example, the use of traditional QWERTY keyboards for phonetically and alphabetically rich text entries.

2.2.3 Characters encoding standards

The internationalization and localization processes must manage and correctly represent the characters of different languages. Each language consists of a character set.

In particular, there are two main steps aimed at representing a language by a machine:

- definition of a character set, including the used characters, punctuation marks, characters to represent numbers, etc.; repertoires can be fixed or open, depending on whether they provide for the possibility of be extended;
- definition of an encoding scheme, which matches each character of the set to an integer, called codepoint.

Encoding schemes can be *single-byte* or *multi-byte (multibyte encoding schemes).*

The coding schemes of the first type consent the representation of a maximum of 128 characters (for 7-bit schemes) or 256 characters (for 8-bit schemes). The multibytes coding schemes can adopt a fixed or variable number of bytes to represent specific characters. In some schemes, such as UCS4, each character is always encoded with 4 bytes. In others, such as UTF8, a character can be concepted with one, two or more bytes.

The main coding schemes adopted in software internationalization and localization (Sasikumar, 2004) are the following:

- *ASCII* (American Standard Code for Information Interchange): it is a 7-bit scheme, which includes all lowercase and uppercase characters of the English alphabet, decimal digits, punctuation marks, some special characters, with a series of control characters (new line, beep, etc.); it represents the basis of almost all subsequent encodings (with the notable exception EBCDIC used on IBM mainframe computers);

- *OEM codepages (Original Equipment Manufacturer*): various schemes of 8-bit encoding, which exploit the unused bit of the ASCII encoding for the representation of different characters (up to a maximum of 128) not present in it (anyway, several producers have created different character sets and encodings for specific languages, and therefore there would be compatibility problems); a first attempt for standardization was in 1972 with the ISO 646 standard, but still in the 80s there were a series of encodings which were incompatible for the MSDOS environment, Microsoft Windows and Macintosh;
- *ISO8859*: it represents a series of 8-bit coding schemes prepared by *ISO (International Standard Organization)* for the support of several reporting officers (*ISO88591* for the Western Europe languages, and *ISO88592* for central Europe languages);
- *ISO10646*: It represents a standard which defines a universal set of characters (*Universal Character Set,* or *UCS*), where both a descriptive name and an encoding point are provided with 31 bits; all the most commonly used characters are coded in the first part of the table, so for the most common uses it just use 16 bits instead of 31;
- *Unicode*: It is an open and public standard, fully compatible with *ISO10646*, created by the *Unicode Consortium*, with the aim of creating a single collection covering all world languages; it also defines several ways for the bits management needed to represent a textual content, by providing full compatibility with capable applications to deal with ASCII data stream.

2.3 Localization tools

Since localizers must translate and adapt each file provided by programmers to a specific cultural context, localization tasks go beyond the single concept of translation, because the localizer must be aware of some aspects of the infrastructure technology that is considered in the internationalization process. Furthermore, the localizer will inevitably use specific IT tools for their work, both to organize it better and to be able to effectively coordinate itself with other professionals.

The idea of creating IT tools to assist in the translation process was born shortly after the Second World War, in an attempt to adapt the technology used by the armed forces to decipher coded messages in order to obtain the translation of documents in "natural language".

In particular, three generations of programs, mainly focused on “automatic translation” (*machine translation*) have emerged since the 1950s:

- the first generation was concepted in the attempt to obtain the translation based on lexical analysis with the application and transformation of grammar rules;
- the second generation was designed around complex semantic models, as translation tries to adapt meanings, relying on one neutral *interlanguage*;
- the third generation, which is known as "Machine Translation based on examples" (*exemplum-based machine translation*), was concepted on textual bilingual databases: for each sentence or word in a language, a probability result was calculated and associated to another textual element in the target language.

In particular, the third model indicates the creation and updating of *parallel corpora* that can be consulted for the translated document. Zanettin (2001) claims that “translators can be relieved in their work with the exploitation of the so-called *translation memories*, which will also be able to be shared with other translators” (p. 93).

Translation memories can be very useful in the context of software localization, especially with the large number of textual elements that are often repeated with identical meanings in different programs.

2.3.1 From automated translation to computer aided translation

In the latest years, the idea to achieve an accurate and fully automated translation has given away by moving to a change of perspective: computers do not provide translations, but only some help in translation; and this aid can be more or less accurate and efficient depending on several aspects, such as the context, available translation memories, etc. In this regard, experts preferred *computer aided translation* instead of "automatic translation". In other words, there will be a translation entirely carried out by the computer, and another one provided exclusively by humans without the help of a machine. These situations represent two abstract extreme points of a continuum where are possible several concrete ways of interaction and collaboration between man and machine.

2.3.2 Translation memories

In the context of *computer-aided translation*, *translation memories* are a very important element.

A *translation memory* is an archive of text segments (such as sentences, paragraphs, and phrases) in a given language, along with the corresponding translation in the target language. The individual words are not managed in the context of translation memories, but are processed using other tools, such as specific terminology glossaries.

In fact, when assisted translation tools open a document to be translated, they classify it into small segments (depending on the user customizations, these can be blocks, periods or individual sentences), and report to the localizer the single segments that needs to be translated into the target language.

At the end, the translators receive both the final document and an archive of correspondences consisting of segments from both the source and target languages, which can be added to their own archives resulting from previous translations.

Since in the field of software localization and translation of technical documentation, segments are frequently repeated, several advantages become clear: each time the translation of a segment is to be obtained, the program will check, through a special algorithm, if there is an identical or similar segment in the archives, and possibly will propose to the localizer the already translated text, so that he can simply confirm his choice, choose from the alternatives proposed, or adapt the proposal to the specific segment.

Also, in the field of translation memories, the proposed matches appear divided into three main categories:

- *fuzzy match*: the content only matches in part (the probability that they are correct would be calculated, even if the way how the estimate is made can change from system to system);
- *literal match*: the content matches perfectly (these are also known as 100% matches);
- *exact match in context*: the content adapts completely and would be interpretable in the same way, as the text is identified or the context has also been analyzed in where the source segment is located; this can be particularly useful when the author decides to assign unique identifiers to the segments to translate, in order to avoid any ambiguity.

Considering the great utility coming from the exchange of translation memories, considering the fact that CAT tools use different file formats for archives and different rules for the

segmentation of texts, different standards have been proposed to ensure interoperability: among these there are the *TMX* (*Translation Memory Exchange format*) for memories, the *TBX* (*Term-Base Exchange format*) for lexical databases, the *SRX* (*Segmentation Rules Exchange format*) for the segmentation rules, proposed by Localization Industry Standard Association, and finally the *XLIFF* (*Xml Localization Interchange File Format*), proposed by the *OASIS* (*Organization for the Advancement of Structured Information Standards*).

2.3.3 CAT tools

CAT tools represent all systems in which a translator uses specific computer programs as an aid to the translation process.

In particular, the localizer can use:

- specific software aimed at the translation of messages within applications (which take the file name "PO"); for example, *POedit*;
- generic programs for the translation of documentation of various kinds (for example, *OmegaT*);
- software concepted for the management of translation memories (for example to merge or compare sentences);
- software created to identify stylistic errors in localizations (for example *Pofilter*).

Generally, the user interface of these applications is quite intuitive. Also, even more frequently, the localization processes take place through special web applications, which allow even to a simple user to offer his contribution by participating in the localization of part of the user interface.

For example, in the Ubuntu Linux distribution, many software has a dedicated menu item saying "Translate this application" that, if activated, leads to a dedicated website, where it would be possible to take part in the localization process, even for the translation of a single sentence.

2.3.4 Error detection in computer aided translation

Both translation and software localization, even if they are performed by professionals, often contain errors.

However, there some useful guidelines have been identified to check their work through the specific tools that report any errors that may have escaped.

Since 2006, the working group of the *Translate* project (http://translate.sourceforge.net/wiki/start) is proposing a list of common mistakes, with a couple of related solutions:

- **uppercase**
  error: following the conventions of the source language (for example, “This Is A Title "which in Italian would be "Questo è Un Titolo");
  solution: following the target language conventions (for example, “Questo è un titolo”);
- **untranslated expressions**
  error: translating expressions that must remain in English (for example, the name of a function to use, such as “get_file_attributes”), which becomes “ricava_gli attributi del_file”);
  solution: leaving these kinds of expressions in English;
- **variables and values**
  error: translating variable names, or some kinds of values that must remain unaltered in a given context (for example, terms like EDITOR, COLOR, GREEN);
  solution: leave the variable names and values unchanged;

- **puntuaction**

  error: deleting punctuation marks and whitespace, adding a period that was not present in the original, or using the exclamation point even when it is not necessary in the target language;

  solution: remaining coherent as much as possible to the punctuation of the original language;

- **HTML and XML tags and attributes**

  error: translating markers, attribute names, attribute values (i.e. “<img src = 'sky. png 'alt ='sky'> ", which in Italian becomes <immag orig='sky.png' alt='cielo'>”);

  solution: leaving markers, attribute names, attribute values, which are however invisible to the user;

- **alphabetical order**

  error: a list of elements, which in the original is in alphabetical order, is left in the same order also in the target language (for example, the list "Danish, Dutch, English, French, German, Italian, Spanish" in Italian would be “Danese, Olandese, Inglese, Francese, Tedesco, Italiano, Spagnolo”);

  solution: alphabetically ordering also the target language;

- **linguistic register**

  error: using the same linguistic register as the original;

  solution: adapting the expressions to the register commonly used in the target language (for example, "Oops! I couldn't open the file" in Italian can become “Si è verificato un problema durante l'apertura del file”);

In addition to these common errors, there may be others, in particular due to the hurry or lack of time.

There are several programs that allow to do some basic checks (for example, identifying pairs of sentences where punctuation marks do not match, or where there are too many spaces etc.)

In addition, some tools (for example, *Podebug* and *Gettextlog*) allow to identify in which context (during execution of an application) a specific period is used (for example for translation quality purposes, or to optimize tasks starting from most commonly used sentences).

2.3.5 Neural network and AI-driven technologies in translation and software localization

As mentioned above, machine translation and AI-driven technologies have been studied for some time with no consistent results.

A real turning point came in 2016, when these kinds of systems became accessible for free; in fact, on 8 October 2016, Google launches its own neural translation system.

Later, also other multinational companies, such as *Microsoft*, launched their own translation software based on artificial intelligence technology.

In particular, AI technologies seem to be capable to deeply change the concept of translation and localization, by taking advantage of the recent studies on machine learning.

All that would allow to produce translations that would be much more accurate than other automatic systems, making them comparable to human translation.

In this scenario, *Neural Machine Translation* (NMT) represents an evolution of the corpus-based architecture. In fact, in neural automatic translation, the corpora of sentences are aligned with the respective translations, using a completely different computational approach designed around neural networks.

The diffusion of NMT systems have questioned the hegemony of statistical architectures. When Google presented its translation service in 2016, it also made available some data on the evaluation of the output performed by human resources, claiming to have bridged the qualitative gap between human and automated translation and localization. As it happens in statistical architectures, the output would be generated on a probabilistic basis during a

decoding phase, but the relevant advantage of NMT is that, in this process, it analyzes each single word of the target text by reporting not only to the source text, but also the previous and next textual content of a target text. The text provided in this way tends to be significantly smoother.

Thanks to the great investments made in this field by large multinational companies, automatic translation, which has now become neural, produces results that are not much inferior to those of a human translator, with greatly reduced time and costs.

Furthermore, the fact that modern technologies are based on the system of neural networks through the tools of artificial intelligence, allow to localizers to learn from their mistakes. In this way, the outputs provided by the system become more and more fluent and understandable for the reader, resulting in greater accuracy. Although this may seem to eliminate the need for post-editing, some studies have shown that greater fluency of content does not always correspond to greater adequacy and correspondence of meaning.

2.3.6 Limitations of neural network and machine translation

As it happens with other forms of machine translation, the main issue of NMT is that the source-text sentences need to be very clear and coherent to have an efficient translation. Every little ambiguity must be inserted into the software at the beginning to avoid ending up with a meaningless translation.

In addition to this, *Neural Machine Translation* can struggle when it deals with highly technical language, with the use of rare words and proper nouns (Bonet; Màrquez; Muntés-Mulero; Paladini Adell, 2012).

There are various aspects that need to be dealt with before carrying out a neural machine translation:

- **The clarity of the text** to be translated, in order to avoid ambiguity issues.
- **Training and human judgement** when dealing with certain specific micro-languages.

- **Data privacy management**: it is essential to know that the most common available translation engines save and store all the data and information they process on their servers. This means it would be difficult or even impossible to guarantee the privacy of customer data.
- **The creativity aspect**: a translation engine trains with its own standard models, and would generally produce translations that, from its point of view, would be the most appropriate with respect to what the algorithms have learned.

2.3.7 The essential need of human implication in neural machine translation

Machine translation, even related to neural networks, still has some shortcomings in relationship with context. In this direction, that human involvement in the process would be required, as a high number of aspects would be beyond the capabilities of AI-driven technologies. The human resource involvement in project management, related with a proper knowledge of neural machine translation specialists, would be required for achieving verified machine translation projects.

This is tied to verified machine translation, or proofread machine translation. Also, this is directly related to *post-edited machine translation (PEMT)*. Performed by localization professionals, which possess a proper knowledge of the major issues of neural machine translation, this process is focused in correcting all those translations generated by automated systems, with the purpose to have a coherent final result in target content. In particular, two distinguished types of post-editing are identified (Carl; Gutermuth; Hansen-Shirra, 2015):

- **Light post-editing**, which is focused on adjusting the machine translation results with a simple level analysis.
- **Full post-editing,** which would deeply analyze the textual content in the attempt to be comparable to human translation.

In particular, Light PEMT would be generally adopted for these specific types of errors: spelling or grammatical mistakes, mistranslations, inappropriate or offensive content, missing words,

etc. Full PEMT, in the other hand, would be more indicated for anything focused on terminological errors, word and sentence structure, or writing style mistakes, and is generally adopted to obtain smoother and fluid content.

Light PEMT would be also adopted to offer a high grade of understandability from textual content coming in foreign languages, and where full PEMT would be adopted to adapt the text coming from machine translation engines, by offering an accurate and high-quality result.

Moreover, Neural machine translation undoubtedly is a big step forward in relationship to perform high levels of usability machine translation tools. In fact, these tools, when adopted in localization companies, would become valuable resources for localization professionals, as they perform proper checks on translated content. In other words, NMT can give some clear advantages to companies:

- First of all, machine translation can allow high-cost savings;
- Also, machine translation can optimize time: in fact, while a single localizer can reach a translation rating of almost 2,000 to 3,000 words per day, machine translation systems only require some minutes to translate and adapt large textual content;
- Eventually, the high level of quality allowed by human resources supervision, achieve a proper project management, with regular quality checks performed by translation and localization professionals.

It is also required that these kinds of AI-driven technologies would be used in presence of human support and supervision performed by localization professionals, project managers, and also software developers. In this way, verified machine translation/localization would allow to perform quicker and reliable tasks, characterized by high-cost savings and by a proper usability.

Summary

The professional figure of the translator/localizer can dispose of a large variety of IT tools and aids to deal with the main open challenges of globalized society, as discussed in the previous paragraphs.

In the specific case of software localization, the localizer must have specific IT skills. With the purpose to manage and master the advanced features of the modern localization tools, the translator should also acquire the knowledge of the most common programming and scripting languages. In fact, as several interventions during the different phases of software development are required, it would be required a fully comprehension of the ways in which modern software is internationalized and provided of multilingual support.

Furthermore, AI-driven technologies still present issues when it comes to addressing the context. For this reason, human involvement in the process would be still required, as several concepts still go beyond the possibilities of these technologies.

In this direction, appears post-modified translation (PEMT - Post Editing Machine Translation). Managed by localization professionals fully aware of the main issues related to translation and localization tasks built around neural networks, this particular practice take place in the correction of those translations performed by automated systems, with the purpose to have a fully readable and coherent content.

Human experience in project management, linked to the advice and knowledge of neural machine translation specialists, would be however necessary for the success of verified machine translation projects.

IT tools undoubtedly are a relevant advantage in terms of the accuracy and reliability of machine translation. In fact, these kinds of tools can reveal valuable resources for localization professionals in charge of supervision of textual content.

Also, the professional figure of translator had rapidly evolved over time, in particular since the phenomenon of globalization.

The new scenarios of modern society present a series of opportunities and challenges that renew and redefine the role of these professionals, offering them reliable tools to help in translation and localization processes. Moreover, information and communication technologies require new hybrid professional profiles within the linguistic and computer science areas, capable to perform a proper linguistic-cultural adaptation (localization) of IT products. In consequence of this, there would be required new transversal skills, both in linguistic and computer science fields.

Even if IT tools are specifically designed for translation and localization, they also are technologies in constant and rapid evolution, especially in consideration that today do not exist a complete automated form of these processes. In fact, human involvement would always be needed to release high-quality digital products.

Neural networks and AI-drive technologies are considered today reference tools on which localization industry is investing, as these technologies are capable to highly reduce the economic resources required for localization tasks.

In this regard, the skills that the translator will have to possess would have as their main focus the new role that these professionals are assuming today. A role that would put them as supervisors of the whole linguistic-cultural adaptation process.

Eventually, the next chapter will be focused on the main linguistic tools and aspect related to localization process.

Chapter 3. Linguistic tools for localization

Introduction

During the development, internationalization and localization process of application, several linguistic issues come out, especially in relationship with lexicon and register to use.

Often, the software developer is a very competent technician concerned on computer science and specific application sectors, but might not have linguistic competencies.

The developer's linguistic and terminological decisions would have some precise repercussions on the work of the localizer: for example, if the vocabulary is not adequate in the initial phases, it would be very unlikely that it can be acceptable in the localized program, according to the principle known as *GIGO* (garbage in, garbage out).

As far as localization is performed, some technical aspects need to be mastered, but having a good confidence in the target language remains essential.

In the wiki of the "Translate" project (2006 http://translate.sourceforge.net/doc/ index.html), there is a page where the ideal translator:

- would be a native speaker (in the target language);
- would be passionate about the study of languages;
- have experience in the field of information technologies and computer science;
- (if possible) have an academic background in the field of information technology or linguistics.

The first point explains how a localization project requires a deep understanding of the target languages in order to use appropriate terminology.

The second point might seem redundant, but a professional who is passionate about their native language is probably less led to give up in translating expressions, and will better understand the need to perform an accurate, complete and consistent translation.

Then, having experience in information technology can be useful in understanding the meaning of certain technical terms (such as the difference between "execute" and "run").

Finally, academic training courses can be useful as they provide specialized knowledge to students, such as information about the etymology of words, or the precise understanding of certain terms and definitions.

In general, however, localization takes place in the context of a team effort in which some linguistic tools, such as glossaries and style guides, are already available, and the localizer has to adapt them under penalty of non-acceptance of his contributions. However, the world of information technology is constantly changing and new terms are constantly being added: consequently, linguistic tools are not fixed and unchangeable, but are in constant evolution.

3.1 Translation and localization support services

In the context of translation and localization projects, a critical aspect would be to ensure a high level of consistency and quality of the target text content. In this direction, there are two support services that would help to achieve these results. They are glossaries and style guides. In particular, glossaries can offer some standardized terminology lists, with the purpose to ensure the proper grade of correspondence of all those specific terms that would be translated in new languages and cultural scenarios. Moreover, style guides are service tools specifically designed for the identification of grammatical rules and writing styles, with the purpose to guarantee the proper consistency to localized content. Together, these two support services would be a relevant aid during the translation and localization processes.

3.1.1 Glossaries

As mentioned before, when talking about Computer-Assisted translation, glossaries represent a translation aid, instead of an entirely automated translation. Besides translation memories, however, every translator can also use "virtual dictionaries" to be able to translate specific terms in real-time.

Glossaries are collections of terms with an indication of their meaning and the context in which they should be used. In fact, they could be adopted both by developers and translators.

When creating a glossary, any already existing one cannot be ignored, as certain term has already been translated in other contexts or in others applications. There would be some differentiation, but it cannot be possible to deviate too much, because otherwise it will create confusion in the end user.

Glossaries can also be useful to ensure consistency within the application (user interface, documentation, etc.) and between applications within a particular group.

As for the developer, here are some errors that can be avoided by using glossaries (Johnson, 2000):

- **inconsistent terminology**: use of different terms for the same concept (i.e. properties, attributes, settings); use of the same term for different concepts (i.e. view, select);
- **unclear terminology**: use of terms that are too similar for very different concepts (i.e., personal planner and personal journal); concepts that are too similar to each other (i.e. membership, subscription, access, entitlements); use of ambiguous terms (i.e. enter, which can mean both “insert data” or "enter");
- **"geek" terminology** (programming jargon): use of programmers' jargon (i.e. buffer, macro, device driver etc.); common words turned into programming jargon (i.e. cat instead of concatenate, man instead of manual etc.); finally, with regard to the term "geek", this has a meaning that defines whoever is a lot passionate about computer science;
- **nominalization of verbs** (i.e. "the compile failed", "start the build" etc.); exposure of terms that have to do with internal implementation (i.e. String, array, exception);

- **assigning arbitrary meanings to generic terms** (i.e., delete for some operations, remove for others etc.).

As long as localization is being performed, glossaries would have particular relevance if several translations for the same term are legitimate: for example, in Italian would we say “click”, “fare clic” or “cliccare”? Will would write “menu” or “menù”? we would leave username or would we use “nome utente”? Creating a personal glossary represents therefore a relevant phase. During the localization processes, as soon as the localizer is in doubt about how to translate a particular sentence, he would have to adopt a solution and add an entry to the glossary, in order to maintain consistency for the future. And if at some point he changes his mind, he would need to update the glossary and be willing to double-check all material already translated.

Obviously, in a group context, the work on glossaries will have to be managed and coordinated.

Some choices may be questionable and need to be discussed. In this respect, the glossaries would suggest different solutions for each specific localization project. The point is that within a given group, it is necessary to adapt to the choices made.

Of course, for all terms that are not in the "official" glossary, the localizer will have to decide how to proceed. In some cases, it will be possible to proceed by analogy (if the localizer is told to leave the term unchanged, he will do the same for the line feed), in others, he will be able to consult different sources (for example, glossaries created for similar projects or applications, discussion groups, etc.).

3.1.2 Style guides

Another important language tool for translators and developers is a document containing a set of stylistic rules to follow. These rules are generally indicative and cannot cover all possible cases and scenarios in detail.

The basis of efficient localization work is the need for clarity and consistency, which, among other things, should be inherent to any software, even in the original language (Monacelli, 2001). In this respect, the software should be understandable both for the user of the localized version and for a native speaker of the original language.

A style guide usually includes:

- graphic rules (use of spacing, punctuation marks, conjunctions, capitalization, program names, quotation marks, special characters);
- rules regarding foreign terms, especially regarding technical terms;
- rules concerning the form and the register, with possible differentiation according to context (for example, what is acceptable for a game might not be acceptable for a commonly used program, and vice versa).

The rules are generally followed by examples in order to be clear; for example, hyperlinks to various resources on the web. The rules defined in the style guides are considered relevant for several reasons:

- not everyone knows the basic rules to compose a text in their own language (for example, in Italian, the punctuation marks must directly follow the preceding word, and must be followed by one space);
- there are some very common bad writing habits, which should be corrected in some way;
- in some cases, the localizer may be in doubt in how to deal with the translation of a given expression, and the style guide could contain expressions to be evaluated by analogy;
- usually, original language software uses a lower register respect of the one expected in a localized program, and the translator/localizer should know how to behave (for example, the original "Please select another option", in Italian should be translated as "Selezionare un altro file", or "Si selezioni un altro file", instead of "Per favore, seleziona un altro file").

3.2 Common errors in localization

Daniele Giacomini (2006), in the chapter dedicated to the literary style of his *Free Computer Science Notes*, is worried because the influence of the English language could cause changes in terms in the Italian language; he also reports some advice dedicated to "anyone who writes in Italian under the influence of English prose, both by translating or adapting even technical documentation coming from English.

Certainly, thinking about the mistakes others have made would help in writing correctly.

The following paragraphs describe the most common linguistic errors associated with the translation and localization process.

3.2.1 False friends

False friends are terms proper of a language that appear to have an obvious translation in another, which however is not correct.

Some examples, related to the translation from English to Italian are:

- factory ("fabbrica") is often translated as "fattoria";
- subject is "l'oggetto di un messaggio", and not "un soggetto";
- to process should be rendered with "elaborare" rather than "processare";
- to return something should be translated as "restituire qualcosa", and not with "Ritornare qualcosa";
- language means "lingua" when speaking of human idioms and "linguaggio" only when it comes to programming languages;
- button would be "pulsante", and not "bottone".

3.2.2 Inconsistency between text and context

An important aspect to keep in mind when creating and managing glossaries is the consistency between the context of the specification application and the more general use of computers, or the consistency between the textual part of the interface and the iconic part.

An example of the first type of problem is the need to clearly define the difference between different ways of closing an operation: in fact, when closing a document, it is possible to also close the program in use, to end the work session, or to turn off the computer. With regard to Italian and many other languages, several terms are consolidated to express these concepts, but sometimes a particular expression (such as "chiudi" or "esci") may be vague.

Moreover, an example of the second type of problem can be found in GNOME icons. In particular, the GNOME 1.x log file viewer icon is represented by an image of a tree trunk, but this design only makes sense if one considers that "log files" are called "logs" in English, where the word "log" also refers to a piece of wood, creating a visual association between the two meanings (Benson et al., 2004).

3.3 Collaboration tools for localizers

The process of software and video game localization usually involves the coordination of several people: a group of programmers/developers on the one hand, and a group of linguists/translators on the other. It is therefore logical to think that there are tools that can somehow facilitate the collaboration and coordination between and within these groups.

3.3.1 Coordination in localization projects

Localization projects involve groups of people, activities, and tools organized to achieve high quality adaptation of specific applications in different languages and cultures; in fact, localizers are usually divided into groups (typically one group per language and culture) that are coordinated internally.

However, the Internet offers countless resources for software and video game localization. In fact, it is possible to consult several glossaries, evaluate the frequency of use of certain terms, and participate in or follow discussions among language professionals.

Finally, the network can be seen as a natural support for the coordination activities of the translators.

3.3.2 Mailing lists

One of the most rapid ways to keep in contact a high number of people are e-mail distribution lists (mailing list).

In this regard, Rigamonti (2005) describes the main steps to follow in order to participate in the localization process of several open source software, related to the Italian language:

- subscribing to the mailing list;
- reading the documentation;
- downloading, filling in and sending the form release to the Free Software Foundation;
- choosing a program not yet translated, by consulting the page of statistics and asking in the list if no one has already started translating it;
- accepting the official assignation about the translation of the program;
- translating the PO file;
- sending the translated PO file for revision to the mailing list;
- making the suggested corrections;

- sending the translated and corrected PO file to a robot that automatically manages the localized versions of programs;
- following the automatic notices that are sent to the mailing list shortly before the release of each new version of the program, downloading and translating the new version of the PO file.

The mailing list is also one of the best places to discuss terminological problems.

In some cases, however, it can be possible to deal with new terms, or terms for which no one had yet reported an issue.

3.3.3 Websites for localization and other resources

As the localization process becomes more popular over time, it was decided to incentivize collaboration on several projects that directly involve users and provide them with a simple interface to approach the localization process.

In particular, this can be useful for users who do not have the time or availability to handle the complete localization of software, but who are interested in contributing to the adaptation of some parts of an application (such as user interfaces, dialogs, etc.).

Several Internet sites have been created for this purpose. One example is *Rosetta* (http://launchpad.net/rosetta), where it is possible to consult the existing translation archives and propose personal translations through a simple web interface. Of course, translation proposals are still evaluated by a member acting as project manager.

A similar web resource is *Pootle* (http://translate.sourceforge.net/wiki/wordforge/index), where it is possible to have access to the PO files in a simple and direct way, offering a personal contribution to localization.

There are several other resources aimed at improving collaboration between people involved in localization projects, or looking to connect programmers and developers on the one hand with translators/localizers on the other.

For example, the *Sourceforge* portal (http://www.sourceforge.net) provides to the open-source developer community an infrastructure for publishing and managing applications. It also offers a special section for finding volunteers; in particular, the developer of a program can ask for the help of volunteers to begin the internationalization and localization processes.

Finally, discussion groups and other resources have been created for some languages that are dedicated to localization.

3.4 Computer science and micro-languages

The computer science micro-language is a subcode, that represents a linguistic variety adopted for specific uses, particularly related with lexicon (Giacomini, 2006).

The subcodes constitute particular cases of diaphasic variations, as the different ways of using a language are influenced by the context or from the subject of the communication.

However, in the analysis of the computer science micro-language, it is also necessary to consider the diamesic variations that depend on the main communication channels used.

3.4.1 Diachronic perspective and the diffusion of the English language

As computer science is a relatively recent academic area, there are two main factors to consider from the perspective of a diachronic study of the "language of computer science".

First of all, linguistic phenomena present in the field of information technology are common to those that have occurred and are present in other scientific fields e cultural.

Also, the rapid evolution of technological advancements is certainly related to the field of information technology; so, it is possible claiming that a few months in the IT domain can correspond, as regards the linguistic sphere, to several decades in others domains.

Eventually, information technologies are closely linked to the English language, and in particular to the Anglo-American variants (Monacelli, 2001). That happens because of the high

investment made in the United States of America, by starting from the years of the Second World War, for the development of these technologies.

In the field of information technology, many technological innovations take place in the United States of America, and when they occur elsewhere, English terms are used to express them, given the globalization of markets.

3.4.2 The origin of computer terms

In this subsection would be described how computer neologisms are created in English through some examples. For many of them it is difficult to find equivalents in Italian or other languages, which explains the reason for a great dissemination of linguistic loans.

The following is an example of the origin of some terms, as described in some documents taken from the World Wide Web (Wikipedia contributors 2010):

• **Personal names**: the programming language Ada owes its name to Ada Lovelace, who is considered the first programmer; the *awk* language was named after the initials of the surnames of its authors, Alfred Aho, Peter Weinberger and Brian Kernighan; the name of the linux operating system comes from the name of its creator Linus Torvalds, with a final letter x common to many system-inspired projects Unix operating; the name of the debian linux distribution comes from the merger of the creator's name of the project (Ian Murdock) with that of his girlfriend (Debra);

• **Wordplays**: the name of the *Apache* web server was proposed by one of the authors of the program, and was also welcomed because the work came started by applying patches to someone else's source code program, and the result was then "a patchy web server" (literally, "a patched web server"); the term nerd is often used to indicate a person which also is computer enthusiast; originally, the word was spelled knurd, and it was used to indicate a student who did not go to parties and stayed to study (knurd is the word drunk “drunk”, written backwards); the UNIX operating system was developed on the ashes of a more ambitious project known as MULTICS (Multiplexed Information and Computing System), that

is was reduced in potential and then transformed into UNICS (later UNIX); if spam is unwanted e-mail, ham 'prosciutto' indicates the emails that are not spam;

• **Alternative scriptures, pronunciation games, mistakes**; some terms are contracted (i18n for internationalization, L10n for localization, m17n for multilingualization); the popular ICQ instant messaging system was named after the pronunciation of the letters (I seek you 'I look for you'); the famous problem of the year 2000 (deriving from the habit of reserving only two figures for storing the year in the archives) was usually indicated like Y2K (year 2000), and there have been several jokes about a programmer who has seen fit to solve it by converting (see the previous point) all occurrences of the letter Y with the letter K (resulting in Januark, Februark, etc.); google, the well-known search engine, has a name that comes from an error in writing (the word googol, invented in 1938, designates the number formed by the digit 1 followed by one hundred zeros);

• **Metaphors and new meanings for common words;** certainly, the best-known metaphor is related to the word “desktop”, on which there are folders and documents; also, the term “cookie” is used to indicate a small amount of information that two applications exchange in order to recognize each other during one work session; Macintosh computers (from Apple) have a name that comes from a type of California apple called McIntosh; the programming language “perl” was named after the positive connotations of the word “pearl”, which could not be used since there already existed a different language with that name; application log files are called logs, like log books of the ships, which in turn are so called because the speed was calculated by throwing a piece of wood (a log) into the sea, tied to a rope;

• **Onomatopoeia, actions performed by the user, and habits;** certainly, a well-known onomatopoeia would be the click of the mouse, but there are also others (for example, the ping command to test if a computer on the network is reachable remembers in its name the noise emitted by a sonar); the action of scrolling through a list of names with a finger to find information of interest led to the name of the software “finger”; the habit of programmers to drink coffee during their work is the basis of a series of names given to programming languages and development tools (for example Java).

Each one of these elements often reflects cultural, linguistic, and technical influences, posing unique challenges in software and video game localization. In particular, when localizing software or video games, it is required to adapt these terms to preserve their functional meaning while considering cultural context. For example, metaphors or wordplays in one language might not have direct equivalents in another, requiring creative solutions to maintain user understanding and engagement.

3.4.3 Acronyms and abbreviations in localization

Very often, and not only in the language of computer science, there are common abbreviations created from the first letters (or sometimes syllables) of longer expressions. If the result is pronounced as if it were a word in itself, and not in its individual letters, the abbreviation is called an "acronym", otherwise it is called an "abbreviation".

It frequently happens that the meaning of the letters that compose acronyms and abbreviations are forgotten: in fact, speakers use the abbreviation or acronym as if it were a common word, sometimes deriving from it different forms (such as the English OK, whose origin is debated, and that is now related to the verb to okay “approve”).

Generally, there are no specific rules on how acronyms and abbreviations should be written; long ago, the praxis was to place a period after each initial, written in capital letters (as in "F.A.Q."), but it seems that this habit is being dismissed: the period is generally omitted and capital letters are transformed into lowercase letters, leading to a substantial undifferentiation from ordinary words.

Furthermore, acronyms and abbreviations can be expressed in the plural, such as nouns, or they can transform into full-fledged verbs. If CD stands for compact disc, a set of discs can become a set of CDs.

The fact that the meaning of the words replaced by the initials in initials and acronyms is easily forgotten, leading to the phenomenon of non-repetition of words. For example, knowing that

PDF stands for Portable Document Format could lead one to believe that the phrase "PDF format" is incorrect, despite the redundancy of the format.

Moreover, in some cases, an attempt is made to reconstruct the meaning of the acronym or abbreviation by knowing only a part of it: a common mistake, for example, consists in stating that DNS means “Domain Name Server” (serving for the names of domain), when it means “Domain Name System” (system of names of domain).

Sometimes, on the basis of an existing acronym or abbreviation, the name is given to an application.

Eventually, in the field of abbreviations, there is a wide range of words that originate from the merge of two or more terms existing to express a new meaning. Some examples could be: “adware” (from advertising and software), “alphanumeric” (from alphabetic and numeric), “blog” (from web and log), “codec” (from coder/encoder), “malware” (from malicious and software), “netizens” (from net/network and citizen), “netiquette” (from net/network and etiquette), “pixel” (from picture and element).

3.4.4 Technical language and jargon

In any field of human activity, the vocabulary is generally specialized; this is true for any profession, and the field of localization is no exception.

Raymond (2003) suggests that, talking about of computer terminology, it is necessary to make a distinction between *general jargon* (slang), *hacker jargon* (jargon) and *technical language* (techspeak). Generic jargon is used by people of the same generation or with similar habits (for example, rock fans or motorcyclists).

Raymond reserves the term jargon for the informal language used by systems engineers, programmers, computer and network experts (hackers), while the techspeak is based on a formal technical vocabulary for the fields of programming, information technology, electronics.

Of course, the distinction is blurred and many terms that originate in the context of technical jargon they can then have formal recognition and become the correct and established way of referring to something even in dictionaries technical, textbooks, definitions of standards, etc.

Moreover, many slang terms derive from a mangling or an adaptation of technical terms.

Among the features of computer jargon:

- grammar is subverted (verbs become nouns, nouns become verbs, plurals are creatively produced);
- the hardware and software are anthropomorphic;
- puns are frequent;
- in written communications, special conventions are used (for example, initials are not capitalized, and expressions are marked to be emphasized according to some conventions adopted in the languages of programming or description of contents, etc.);

The technical jargon began to develop in the 40s, in parallel with the development of electronic and information technologies.

3.4.5 The phenomenon of leet Speak

A specific type of jargon used in written communication on the Internet or in smartphone messaging is known as *leet* or *leet speak* (Mitchell, 2005), which is based on the substitution and permutation of characters in the text. In this way:

- some letters are replaced by similar symbols or characters ("4" Instead of "A", "3" instead of "E") or by combinations of characters ("M" becomes "| \ / |" or'^^');
- letters with a similar sound are exchanged between them ("z" instead of "s", or "x" instead of “k”);
- some letters are omitted (for example “very” becomes “vry”);
- uppercase and lowercase letters are freely mixed;
- some spelling errors are made deliberately;

- the words are anagram.

The origin of leet originated in the 80s, when with the diffusion of the first amateur telematic communication systems (BBS, Bulletin Board System), someone felt the need to escape automatic filters put in place by the administrators: if the filter checked the presence of the word porn or pornography in the messages, it was enough to type “p0rn” or “pr0n” to bypass filters. In the early 90s, leet became popular among the fans of interactive online games, and with the diffusion of forums and blogs on the internet, leet has acquired great popularity.

3.4.6 Italian language and computer science

Considering the high number of neologisms produced in the field of information technology, all those languages coming from non-English speaking countries are subject to relevant problems if they want to maintain a high degree of coherence and an efficient vocabulary, which would not be limited to the importation of loans and calques from local languages.

During the 50s and 60s, the lexicon settled down with some control over the diffusion of Anglo-American technicalities: translators, scientists and linguists in several cases propose acceptable solutions, sometimes shared with those adopted in other languages of Latin origin. This is the case, for example, with the term "information technology", originated in France (informatique) in 1962, and contrasted with the English computer science. For some concepts, however, the original term is usually kept, possibly accompanied by an explanation.

Since the end of the 60s, a lower propensity has arisen from the adaptation of the original terms.

In the 80s, with the spread of personal computers, Italian users begin to familiarize themselves with files, databases, word processing etc.

The *DOS* (Disk Operating System) operating system is used for managing basic commands with names in English (“backup”, “delete”, “set”, etc.) from which Italian verbs of dubious value are derived (“backuppare”, “settare” etc.).

With the advent of graphical interfaces, the user clicks with the mouse and selects the font to represent the characters of the document being written.

The subsequent 90s were characterized by the widespread access to Internet, which in one hand led to easy retrieval of technical documentation updated in English, and in the other hand brought the ability to communicate synchronously (instant messaging and chat) and asynchronous (email, discussion groups, etc.) at national and supranational level.

Regarding the first aspect, it will be necessary to keep in mind that all programs required by cutting-edge user are developed and documented in English: in reading the documentation and in use of the interface, therefore, it is inevitable to collide with terms in that language which, if even if a translation or a calque were possible, they are often kept in original language, in order to easily exchange opinions or request information to other users. The application user interface is often localized only later and sometimes it is too late, because the original terms are already entered into use beyond the critical threshold that would allow some adaptation to the Italian language.

In communication, English terms and acronyms are widely used even when it would be possible to do otherwise, and innovation linguistics is stimulated by the speed and efficiency of new media channels, which, among other things, lead to a proximity to the proper registers of spoken language.

3.4.7 Synchronic perspective

The impact of technologies, such as information technology and telecommunications in the Italian language is remarkable, since these are no longer languages that can be defined as "sectorial". Electronic computers come used for everyday life in a transversal way. Genarally, every house is equipped with digital devices. People keep in touch by emails, and

communicate through several specific web channels, even to quickly obtain information on more varied topics. For all these activities, a minimal IT competence would be required, as this competence passes through words that do not appear immediately understandable. In other words, people learn new words, often ignoring the meaning and the origin of them.

In this complex and varied context, it is even difficult to speak of a "language of information technology": it is necessary to define the field of investigation. First of all, it is important to say that the traditional distinction between written and spoken language should be reconsidered, taking into account the different forms of online communication.

Moreover, the type of computer activity is relevant (for example, system engineers and programmers are more exposed to technical documentation in English, as they must create documents, applications, and procedures descriptions in English; then, the so-called end user will be able to count instead on a user interface completely in Italian, and then assimilate the concepts that he needs directly in his own language).

However, each scenario is complex and multifaceted: it is only in some of these (and possibly others) distinctions that it will be possible to analyze the lexicon used. The Italian verb "backuppare" (to make a backup copy) can be considered acceptable in some contexts and not in others: this verb probably does not exist in a dictionary or in a technical text, but it is common in oral language.

3.4.8 Linguistic interferences

Linguistic interference, or the contact and mutual influence of different languages, almost represents the basis of all languages. The influences are of various nature, with some particular cases for which it is advantageous to use specific terms, by referring in particular to the study of Gusmani (1986).

The linguistic loan represents the "possible consequence of this process [interference], which occurs when the element that was the subject of the interference, through its diffusion to an ever-increasing number of idols, becomes part of it, integral to the linguistic system that has been influenced" (p. 138). Derived from an imitation activity where it is possible to reproduce, in a target language, elements previously found in another one, where there is a receptive aspect, but also an "interpretation and original reworking of external influences" (p. 15). Some examples of loans from English would be: jet, flirt, goal, bar.

It often happens that a polysemic term is accepted in a language in only one of the possible meanings. There are also cases where some connotative characteristics of the loan (acquired by the fact of remaining in some way connected with the foreign environment from which it was introduced, or that it is able to evoke) will characterize its value, possibly causing a "semantic polarization".

Loans can be more or less "acclimatized", depending on the degree in which become a constitutive part of the lexical heritage of a linguistic system, even if acclimatization can sometimes only concern a well circumscribed one.

Moreover, "Integrated" loans are those in which term is adapted to some extent (for example, in respect to pronunciation or spelling) to the language indigenous. This is the case of “goals”, from the English “goal”. But it is possible to understand how also integrated terms from which others are derived according to ordinary the rules (as in the case of bar, from which bartender is derived, or the term film, from which they are filming derivatives, filmology, etc.).

Another type of interference is the semantic calque, based essentially on two types of phenomena: those in which a “new linguistic element is created which, while combining material already present in the imitating language, it enriches with a unit the lexical inventory of the same language and those that consist of a change in the function of an existing unit”. (p. 220).

In the first case we will have a "structural calque", in the second a "semantic calque". A classic example of the first type is skyscraper (from the English “skyscraper”); an example of semantic can be the term realize (from English “to realize”), in which a new meaning (“understand”) is added to the term that already existed.

There are also cases of "hybrid" words: these are typically derived from a compound in the original language, so one of the elements constitutive is replaced with the original term (as in the case of tramway, from which derives tramway).

3.4.9 Linguistic loans and semantic calques in software localization

Linguistic loans are made out of necessity or prestige. In the first case, a foreign term is adopted because there is no adequate term in one's own language to express a certain concept.

Among the loans adopted by necessity, there are those for which the English term is synthetic and expressive, and would require long periphrasis in other languages.

In other cases, a foreign term is used instead of an existing equivalent in other languages, in order to emphasize one's linguistic competence.

A semantic calque happens when a foreign language term is translated into another, also by adding a new meaning.

Some Italian examples of semantic calques can be “scorciatoria” (from shortcut), “collegamento” (from link), “cestino” (from recycle bin), “scrivania” (from desktop) or “cartella” (from folder). In these cases, it is difficult to say whether it is a new one meaning that is given to the already existing word taking as a model that the new meaning of the word had in English.

Special cases arise when the translation is wrong, but despite this the new meaning actually comes into use and, over the years, no one even realizes the initial mistake anymore. This is the case of paragraph, which corresponds to what in Italian would be a "capoverso", and that instead it is translated as "paragrafo" or the word consistent ("coherent"), which passes in Italian as "consistent". Also justify (from English “to justify”) and indent (from English “to

indent") fall into this category. In these cases, there is a "calque for false motivation", which is frequent for the existence of false friends.

Among the structural calques it can be mentioned terms as "salvaschermo" (from "screensaver"), "base di dati" (from "database"), "senza fili" (from "wireless"), "posta elettronica" (from "electronic mail"). Eventually, it can be noticed that in common usage, the terms in English still come often preferred to those in Italian.

3.4.10 Polysemic issues

When a polysemic term is imported as a loan, it is usually kept only the specific technical meaning. In fact, there is a "polarization" of meanings in the original language: for the original polysemic web *cobweb*, which adopts both to the work of the spider and to the set of hypertexts logically connected to each other and made available on Internet, in Italian there will be two terms, *cobweb* (which keeps its original meaning) and web, exclusively adopted for the specific meaning.

In other words, a series of terms related to the semantic universe of the original term (for example, *spider*, which also distinguishes a software capable of "exploring" the web) will be understood only in the condition of retracing the original meaning.

On the other hand, it sometimes happens that (in the case of specialized language terms) computer science English translations are proposed with two different meanings, causing polysemy in other languages.

Similar cases happen with the terms *web* and *network*, both translated with *rete*.

Then, both *download* and *unload* are translated with *scarica*, but the context of use is almost different (from the network in one case, from the memory in the other) and do not cause issues.

3.5 Comparative linguistics and parallel corpora

Talking about the Italian computer lexicon, the reference often goes to the terms deriving from loans or calques from English. However, it is relevant to see if other languages of Latin origin would have similar problems in terms of linguistic interference.

While the studies of traditional linguistics were mainly concerned with the study of grammar, with the aim of pointing out the rules to be followed in order to write and speak well, in the nineteenth century linguistics began to see itself as an autonomous science, equipped with its own methods, objectives of analysis and theories to be verified.

A greater availability of data in different languages has allowed several comparative studies (for example those related with languages of Indo-European origin) through empirical data, theories and generalizations concerning the phonetics and dialectology. Between the end of the nineteenth century and the beginning of the twentieth century, linguistic data began to be collected in a targeted and systematic way, up to the birth and development of *linguistic corpora*, characterized by statistical analysis.

In the last decades, however, *linguistics corpora* have had a notable relaunch, thanks to a growing availability of corpora to be analyzed, such as programs, dictionaries, etc. (Spina, 2001).

Parallel corpora are relevant for cross-lingual comparison work because they arise when textual content is available for two or more languages that systematically translate each other. Some examples of parallel corpora, outside the field of information technology, may be those related to the laws of bilingual countries (e.g. Canada) and international organizations that produce multilingual texts, such as the European Communities countries, which have developed and established calibrated glossaries to avoid confusion with national uses (Hagège, 1995; Lasorsa & Paleari, 2001).

When analyzing the use of a single language, it is possible to make statistical observations, since one of the objectives of localization projects is to ensure consistency between an original term and the target language. What can be easily done, however, is a comparison between languages.

3.5.1 Computer lexicon in comparative linguistics

The first comparison that can be made regards some terms commonly adopted by computer scientists, with whom the standard user has to deal when he starts to use a computer, regardless of why he uses it.

For example, for the term “file”, a linguistic loan is used only for Italian language, as for other languages there is a specific term (for example “fr: fichier; pt: ficheiro; ro: fişier”).

For the term “directory”, a loan is adopted for all languages except for French (for example “fr: répertoire; it: directory; pt: directòrio;”).

The mouse is called by its English name only in Italian, and in other languages such as French and Portuguese the term is different (for example fr: souris; pt: rato”).

A loan which is common to all languages is pixel.

3.5.2 Audiovisual elements in comparative linguistics

Some other examples can be made when talking about audiovisual elements.

In the image manipulation software, the Italian user can make a fuzzy selection (for example, “en: diffuse flint; fr: contiguous sélection;”) and the images are organized in levels.

The problem arises when noticing that some terms in English have equivalents in Italian only from a terminological perspective, but not in their deeper meaning or usage. (for example, “ca: nivells; es: niveles; fr: niveaux; ro: nivele”).

Moreover, audio and video contents are characterized by a certain number of bits in according to provide a proper reproduction. An example can be the term bitrate (“ca: ritme de bit; fr: débit des données”).

Similarly, in a movie the number of frames per second is called framerate in Italian (for example “fr: images par seconde; gl: fotogramas por segundo;”).

Summary

Localization of application software and videogames is deeply related with peculiar linguistic tools and aspects, as internationalization and localization processes are affected by a large number of variables.

First of all, linguistic phenomena such as false friends, technical lexicon, loans and abbreviations, can cause potential issues in the relationship between text and context.

In addition, because localization is a complex process that requires a significant number of human resources to work on a project, the resulting teamwork requires proper coordination.

In open-source contexts and environments, open projects are often available where any user/translator can contribute to the localization process through a dedicated portal/website.

Each team of translators uses specific linguistic resources, such as glossaries and style guides, in order to make their work more affordable.

In this regard, a relevant aspect that the translator needs to consider is the computer science micro-language. In fact, more and more new technical terms are being created every day from English and need to be adapted into other languages, even the low-resource ones. This leads the translators towards the study of comparative linguistics, by taking into account the concept of *parallel corpora*, which are collections of texts, each of which is translated into one or more other languages than the original.

Considering all these points, the next sections of this thesis will propose a specific case study in which the localization process of a video game will be analysed from technical, linguistic and socio-semiotic aspects.

Chapter 4. Game localization skills between creativity and accessibility

Introduction

In order to give a contribute into the definition of the role and the skills needed by modern translators and localizers, this study would be focused in two key aspects proper of game localization and interactive storytelling. In this regard, the first important aspect is related to the use of creativity by localizers; in fact, although modern technologies such as *CAT tools*, *machine translation* and *IA* certainly represent a very strong aid in both translation and localization processes, they are not perfect. Then, the use of creativity is necessary to make high standard adaptation of the products.

In particular, the use of creativity is deeply linked to many aspects of game localization, such as transmedia interactive storytelling, the PEGI content rating system, nonlinear dialogues etc.

The second relevant aspect is related to the accessibility field. In game localization, there is the need to adapt textual and audio contents in order to make the software usable by a large variety of users/players; this regard, some examples can be players with cognitive or physical disabilities or children. Also, other accessibility related topics could be the proper support for low-resourced languages, the gender questions, or crowdfunding as supporting tool aimed to add new useful features in a game.

Also, the game localizer has to deal with the use of texts and sounds meant as components of the user interface.

4.1 Creativity in game localization

In the field of translation, and in particular in the area of multimedia entertainment, the concept of creativity is complex and related to many different aspects. For example, creativity can be linked to the text, to the cultural background of a specific market/scenario and to the authorship of a product (Gnoffo & Pirrone, 2023).

In addition, localizers must deal with marketing requirements and other possible constraints imposed by software houses or local laws. (Gnoffo & Pirrone, 2023).

As localization phase - especially in interactive entertainment field - is challenging, and it would require a specific teamwork for every specific *locale*.

However, while both modern translators and localizers regularly debate creativity, they also have a certain amount of fear because high levels of creativity can imply undue liberties with the source text. In addition, creativity is deeply intertwined with the concepts of authorship and copyright, which can lead to doubt and confusion. (Bernal-Merino, 2018; Gnoffo & Pirrone, 2023).

In this regard, the linguistic and cultural adaptation of creative products cannot be completed without taking into account the creative aspects in textual content. In particular, creativeness is directly related with authorship; so, this means that both original and target content would take advantage from the creativeness belonging to original authors and localizers. So, all the aspects related with copyright and royalties would be tied to legal systems and local laws.

In other words, while localization professionals depend on the original textual content that need to be translated, in the same way the authors depend on localizers in the attempt to reach other markets and cultures. This is due to the fact that recreational products are polysemantic artefacts. In particular, they are designed to trigger emotions through a certain number of signs.

A description of the translation process of entertainment products has been highlighted by a high number of scholars, also in relationship with several topics: interactive storytelling in digital games (O'Hagan & Mangiron, 2013; Bernal-Merino, 2014), literature for children (Klinberg, 1986; Lathey, 2006), story books (O'Sullivan, 1999; González Vera, 2011), comics (Zanettin, 2008), news (Bielsa & Bassnett, 2008), movies (Díaz-Cintas & Remael, 2007; Chaume, 2012), and pop videos (Hewitt, 2000; Kaindl, 2005).

There are several factors that have been focused on creativity related to text-only analysis over time: media channels (which are meant in relationship with textual format); history (in relationship with several topics reported in old and ancient texts); the object of study and

reproduction rights (polysemantic products usually cannot be accessed because of reproduction fees).

In conclusion, audiovisual translations are usually performed in consideration of multimodal approaches. In fact, unlike traditional media, videogames are deeply related with the interplay of several communication modes, such as texts, visuals and also interactive elements. In this direction, localization professionals operate with these elements to deliver both narrative and gameplay mechanics.

4.1.1 The role of modern translator/localizer

Human experience in localization project management, combined with knowledge of the latest translation technologies, to ensure the success of digital products. (Gnoffo & Pirrone, 2023).

IT tools therefore represent a significant step forward in terms of efficiency and usability of machine translation engines. These kinds of translation aids, if enriched and classified in sectors, would represent a high-quality resource for translators.

In addition, IT tools should be backed up by human support from translation professionals, project managers, developers and localizers. (Gnoffo & Pirrone, 2023).

In this direction, methodologies such as post-editing or verified machine translation can help ensure that adaptations are fast, consistent, accurate, less expensive to produce, and appropriately tailored to a specific subject area. (Gnoffo & Pirrone, 2023).

The advent of new scenarios in modern society has presented a list of opportunities and challenges that have the potential to renew and redefine the role of the translator, thereby providing them with different kinds of translation tools; in fact, while information and communication technologies have facilitated the emergence of novel professional roles within the linguistic domain, particularly in the context of IT product localization, these roles necessitate the acquisition of new cross-disciplinary competencies, including linguistic, international cultural, and IT expertise. (Gnoffo & Pirrone, 2023).

While the number of IT tools dedicated to translation and localization is on the rise and constantly evolving, a complete form of automated translation/localization has yet to emerge. This is partly due to the lack of creativity, which means human involvement is still necessary. (Gnoffo & Pirrone, 2023).

In addition, AI-driven technologies, such as neural networks and machine learning, represent today a standard in both academia and industry, as these tools (with human support) are able to reduce the time and cost of translation and localization processes. (Gnoffo & Pirrone, 2023).

In this regard, the key skills that the translator/localizer will be expected to possess will be focused on the new role that these professional profiles are taking on today; in fact, this role is becoming increasingly defined as that of a supervisor of linguistic and cultural adaptation processes pertaining to the products in question (Gnoffo & Pirrone, 2023).

4.1.2 The use of transcreation

An important aspect of game localization is the necessity to correctly transpose narrative contents to a target linguistic/cultural scenario.

Transcreation (Šiaučiūnė & Liubinienė, 2011) is a technique used within the localization process with the main purpose to transpose linguistic elements from a cultural scenario to another one. In the videogame field, there would be countless examples of this practice.

In fact, transcreation is generally used in the field of marketing, specifically in advertising campaigns, billboards, flyers and slogans related to specific products and brands. In this context, the general concept of translation would not be sufficient. Then, the impact that the text needs to have on the public audience includes a very strong emotional component. In fact, certain elements such as puns, rhymes, and other linguistic strategies are often used. (Gnoffo & Pirrone, 2023).

Other areas in which transcreation can be used are web content (websites, blogs, sponsored advertising campaigns provided through social media, etc.), this happens because they represent the most common channels used for making a brand known in different markets. In

other words, transcreation not only can make the content suitable for target audiences, but it can also be useful for properly perform *Search Engine Objects* (SEO)-friendly language adaptations.

This happens because, within the transcreation process, the translator is able to modify the used words by searching for the linguistic equivalent in the target language, which is used as primary keyword at a linguistic and cultural level, taking into consideration online trends.

In the area of videogames, digital products require a certain degree of technical localization, due to various specific types of restrictions (which are related, for example, to the available space on the display section). Moreover, transcreation represents an important element in the adaptation of videogame content to a specific audience, perhaps located in a different geographical area than the original one, with the purpose to respect the restrictions imposed by development and either from a cultural point of view. In addition, space constraints in localization often require a degree of transcreation, as adapting text to fit limited space while preserving meaning, tone, and cultural relevance requires creative reimagining.

Also, O'Hagan & Mangiron (2013) highlighted specific contents and contexts upon which transcreation can be applied in videogames:

- **Irony and idiomatic expressions**. Irony is a factor deeply related with culture, and often elements such as jokes and exchanges can be either misunderstood or not fully comprehended if they are translated literally. Transcreation is often used in localization with these types of content, as there is often the need to completely rewrite them, as the semantic aspect would be absent in the target language. Another type of linguistic content that often cannot be literally translated, due to need for creative adaptation, are idioms and proverbs. In fact, sometimes it happens that in the target language there is already an equivalent meaning, but other times a creative translation would be required;
- **Characters names**. Although in recent years industry is choosing to keep the original name of the characters, it could be necessary to proceed with the use of transcreation. This could depend from some possible linguistic issues, such as pronunciation

problems, lack of meaning or reference to inappropriate content in the target popular culture;

- **Technical limitations**. In certain situations, even if the standard localization practices could be adequate in terms of content and meaning, there could be issues at a technical level. For example, it can occur a practical problem when the display available space does not consent the use of a certain number of words. Languages such as Japanese, Chinese or Korean have an advantage in this direction, as they generally manage to use a low number of ideograms to express large varieties of meanings.

4.1.3 *Pivot languages* and *Engrish* in software and game localization

Multilingual digital products are often developed with the use of English as source language. However, in some cases, the native language can vary.

When the source language is a different language, it can be difficult to directly transpose the linguistic contents to the various target languages. This can be the case of low-resourced languages, or peculiar ones such as Japanese, Chinese or Russian. In these scenarios, it can be useful adopting a *pivot language*.

A pivot language is aimed to make a bridge between the source language and the target ones. In a lot of cases, software and game localizers use English as pivot language (Zhang & Song, 2023).

In this direction, an efficient way to adapt linguistic contents is to adopt a pivot language approach by using languages coming from the same family three. Also, any eventual usage of jargon would be easier.

Each one of the mentioned approaches would enhance the level of accuracy in the localization process.

Moreover, both pivot and source languages should also share a similar cultural scenario, in order to reduce any possible wrong interpretation of the context.

It is also needed that translators/localizers would have familiarity with the various cultural contexts, in order to have some relevant knowledge about the source texts.

Finally, it is important to correctly identify the type, context, and original media channel of the text to be translated; for example, a text may be part of a video game or a movie. Consequently, the target/audience would be different for games.

In other situations, the localizer should select the correct speech style, such as formal or informal language, but also specific lexicon etc.

Another relevant topic in software and game localization is about the bad adaptation of certain meanings. In fact, some sentences show a complete lack of meaning, often due to the use of literal translations in idiomatic expressions. As this mainly happens with English language, these kinds of translations are informally defined as "Engrish".

Engrish is also defined as a simple and sloppy form of English with a very limited vocabulary. This term also identifies all digital products that present wrong and meaningless translations.

In other words, this term is frequently associated with poorly executed translations, resulting in sentences that are grammatically flawed, nonsensical, or unintentionally humorous. Engrish is commonly found in digital products, such as video games, apps, or user interfaces, where translation errors occur due to a lack of linguistic expertise or cultural understanding. In fact, these errors can deeply affect user experience by making the content confusing. The term also highlights the broader challenge of ensuring quality in localization processes to effectively convey the intended meaning across languages and cultures.

4.1.4 PEGI content rating system in game localization

Videogames are today extremely varied and comprehend a countless number of genres. Consequently, audio-visual contents can present important differences.

As the age of the player ranges between a low and high numbers, there is the necessity to classify videogames contents, so that it would be possible to recommend each product for a specific age range.

In order to do this, there were established specific rating systems with the aim to make a classification of videogames contents.

In Europe, the reference rating system adopted is the Pan-European Game Information (PEGI). PEGI system is active since 2003 and presented five indicators, in the official guide available at https://pegi.info/.

Each indicator is characterized by a number (which refers to the recommended age for players) and a color (green, yellow and red). The indicators are reported below:

- Indicators 3 and 7 (green): Videogames with no visually violent content and without talk of drugs or sex;
- Indicators 12 and 16 (yellow): Videogames with moderate violence and limited sexual contents and vulgar expressions;
- Indicator 18+ (red): Videogames where drugs, sex, illegal activities are not only present, but they are promoted as profitable activities and the player could be involved in them.

As videogame localizers must consider the specific classification of a product, they can face some issues related to the target cultural scenario. In fact, certain contents or idiomatic expressions could be considered acceptable in a country, but banished in another one.

Also, certain marketing campaigns and strategies could represent a problem in particular countries, with the possible consequence of products retirement.

In these scenarios, one of the possible solutions for software houses could be to have a multicultural localization team, with the presence of components belonging to the various linguistic-cultural scenarios. In this way there are some advantages, such as the possibility to be informed about local laws and praxis, and to know every specific cultural background.

4.1.5 Interactive transmedia storytelling

Digital media have today a strong influence on development, production methodologies and use of content. Especially, some modern productions (including videogames) are designed on the model of *Transmedia Storytelling*, a type of storytelling which takes advantage of different media platforms in order to spread contents through them. Then, each story makes its own contribution to the construction of a wider meaning (Jenkins, 2003).

To better understand the concept of Transmedia Storytelling, its characteristics and its cross-platform nature, it is necessary to refer to Henry Jenkins (2003), which was the first to introduce this topic.

In 2006 he wrote more about transmedia storytelling in his most famous essay, *Convergence Culture, where old and new media collide*.

The volume outlines the modern popular culture and describes the main big changes caused by information technologies, including the new communication modes that are established between people and communication platforms. Everything is analyzed from the point of view of content creators in favor of digital communication channels, including the Internet, but also video games or mobile applications.

In the context of multimedia, the concept of convergence is identified with hybridization, or the ability to create tools capable of delivering information and specific services, helping to create a sort of overall storytelling that can break barriers and limitations proper of a single medium capability.

This kind of hybridization makes technological objects as protagonists acting as phones, TV, radios, navigators or more. This kind of multifunctionality is able to decline contents in several formats, which are easy to use and to distribute in an increasingly pervasive way.

The new media allow audience and users not only to deeply interact with contents, but also to identify the main limits of the content flow, by choosing what and when to watch or listen to.

On one hand, possible interactions between different kinds of new media can appear as reproposing and re-sharing contents through personal channels. However, according to Jenkins (2003), this represents a necessary step in understanding interactivity, as it would be a practice that refers to the creativity of small amateur productions, typical of popular cultures.

Based on these aspects, Jenkins has identified some relevant issues related with the digital training of future society. The principles of this approach are reported below:

- the need to work to make conscious participation in the use or creation of content safer
- the need to establish rules on the transparency of news and sources, a problem that is already deeply felt with traditional media
- the need to reconsider the idea that technology is a dangerous generator of social problems.

Jenkins (2003) also defines transmedia storytelling through the description of its constituent characteristics, which can also be seen as elements in determining the basis of any Transmedia Storytelling project:

- Spreadability and Penetrability
- Continuity and Multiplicity
- Immersion and Extractability
- World building
- Seriality
- Subjectivity
- Performance.

Each transmedia project takes the form of a specific narrative that can be expressed in the form of a film or other audiovisual product such as video games, podcasts, comics, etc.

An important characteristic of these storylines is that each is independent and autonomous, offering a unique experience that is different from the others. This means that each experience must be accessible to people who haven't tried the others (Jenkins, 2003).

In addition, each piece of content can't simply be an adaptation of the same story in a different medium. Rather, each medium/device must use its own specific characteristics to propose a different perspective of interaction with a central story or narrative universe.

In this way, each aspect coming from a specific channel/device will be part of a kind of cognitive mosaic, built not only from the elements provided by the original creators, but also from the actions and interactions performed by readers, users or players. Contents displayed on videos, images or video games are just some of the additional elements that have further expanded the concept of narrative, making it a large collective environment.

4.1.6 Nonlinear storytelling in videogames

The idea of linear storytelling, with its traditions and applications, is now well established. In this regard, a common of doing this is the "three-act structure" or "Aristotelian approach," which facilitates the discernment and decomposition of the stages that compose a narrative. (Prosser, 2014; Gnoffo & Pirrone, 2023). In other words, a problem is presented at the beginning; it generates a series of events that culminate in the central part of the story, after which the problem is somehow resolved. This structure is particularly effective in video games because it provides the player with clearly defined set of objectives, which must be accomplished in order to successfully resolve a problem (Gnoffo & Pirrone, 2023).

Non-linear narratives - especially in this context – go beyond linear ones. In fact, in these cases, players can choose between several options. In the past, these narrative paths have frequently

been presented as fixed alternatives, such as choosing between two or more predetermined destinations. Nonetheless, non-linear stories go beyond presenting choices as narrative paths. It also includes video games that dynamically generate story elements and change potential endings based not only on the player's choices, but also on other factors such as performance, timing, or other narrative-related circumstances. it is, therefore, variability. The player's experience is enriched by variety and a sense of effectiveness. What the player does has real consequences on the world in which he interacts; in other words, he is at least given the impression of influencing events.

Non-linear narratives applied to video games can offer multiple endings or strongly influence the development of characters and events. The moment a player is given the ability to influence the narrative, they are automatically given the opportunity to identify with their character, creating more than just an emotional investment. Even with non-linear narratives, while the content may be pre-determined, the user can still shape the order in which events unfold.

And, although each user receives the same introduction to the narrative and, in most cases, the same final sequence of events, they are still able to customize their gaming experience by creating their own path.

In this context, each segment of the story must be autonomous, without dependence on previous experiences or scenarios; the elements work together like a jigsaw puzzle to present the full picture. Puzzle adventures like *Myst* demonstrate this approach by offering a free-roaming experience through related challenges.

In this case, some puzzles are added to the model of free exploration of the scenarios typical of free-roaming video games; these puzzles represent challenges that can be solved in a different way and that assume relevance in the understanding or development of the story. For example, it is possible to use or combine some objects or take advantage of some characteristics of the game environment.

Only in the end, when all the pieces have been explored, is the plot fully understood and the conclusion makes sense.

In the field of non-linear narrative, a new multidisciplinary interest has emerged toward the end of the new millennium, known as interactive digital narrative and emerging narratives. (Hargood et al., 2008). Encouraged by the growing use of technology in the audiovisual sector, interactive digital storytelling has been defined by Miller (2004) as the use of digital media platforms and interactive elements to create narratives (fictional or non-fictional) in which users can actively shape the course and sometimes the content of the story. (Gnoffo & Pirrone, 2023).

In his short essay published in 2005, Spierling (2005) analyzes the main factors that influenced the birth and subsequent expansion of interactive digital storytelling: the first is related to the attempt by audiovisual professionals to automate the movements of virtual characters by defining their capabilities based on rules of "intelligent" behavior.; the second is related to an attempt by human-computer interaction (HCI) practitioners to use storytelling to make computer applications more understandable and more compelling (Laurel, 1993); the third factor is related to the game design sector, which has begun to consider computer games as interactive artifacts (Bertolo, 2020; Crawford, 1993; Rouse & Ogden, 2000); finally, the AI industry has taken an interest in automated storytelling in response to user input, building story engines and planning the actions of autonomous characters on a virtual stage. (Pirrone & Gnoffo, 2023). It is therefore clear that interactive digital storytelling emerges from the combination of different points of view and needs from different disciplines, mainly audiovisual arts, information technology, human-computer interaction and communication sciences. (Gnoffo & Pirrone, 2023).

Focusing our attention on the game design sector, it should be noted that in recent years, games based on interactive digital storytelling have become increasingly popular as they provide the player with a motivating and engaging experience (Dille et al., 2007). However, some game designers consider a true "interactive story" as a goal not yet fully achieved, since it is often not possible to give the player the feeling of actually having an active protagonist role within a personalized narrative path.

Scientific literature offers several classifications of non-linear storytelling in videogames. The types of nonlinear storytelling in video games are classified into two main categories: branching narratives and emergent narratives (Hargood et al., 2008).

Prosser (2014), refers to the following interactive digital storytelling techniques: *branching*, *parallel*, and *dynamic* narratives.

One effective method of improving the connection between the game and the narrative has been to give the player an active role in how the narrative will unfold. This is what happens in the branching narrative model, where the story, rather than remaining linear, is designed to branch out in different directions, as shown in Figure 1.4.

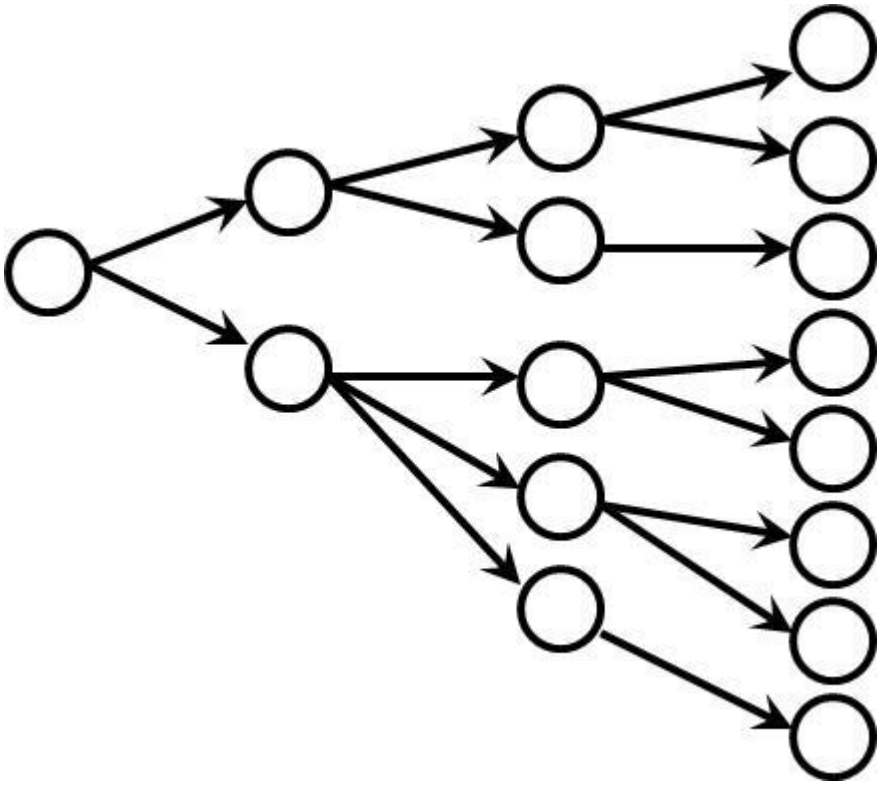

Figure 1.4 Branching Narrative. Source: Game Design Concepts by Ian Schreiber (https://gamedesignconcepts.wordpress.com/).

Branching narrative (Prosser, 2014) constitutes a first alternative structure to linear narrative. In particular, branching narratives are the most common attempt at an interactive drama in which the player's behavior materially influences the conclusion. As described by *playwithlearning.com,* "instead of a single continuous storyline, branching narratives offer the user sequential choices. Each decision offers a unique path into a diverse range of events"

(https://playwithlearning.com/2010/10/21/exploring-interactive-narrative-part-2/). While these events are limited, branching narratives give the user control over the course of action. In other words, this type of narration allows the user to determine the direction of a path, and therefore its destination. The game developers determine all available options, but the user decides the path through them.

Despite current attempts to implement variable situations within a video game, every decision and outcome is, if not totally predefined, a consequence of predetermined patterns and rules (Prosser, 2014). The constraints of production mean that the narrative cannot be entirely free. Instead, the producers regularly bring the narrative back to shared nodes. These nodes appear as the consequence of possibly unrelated decisions and in fact provide a means of limiting outcomes.

Another technique is the parallel narrative, which stands out because it refers to parallel sequences of events, different according to the choices made, which accompany the user during the gaming experience. A reference diagram is showed in Figure 4.2.

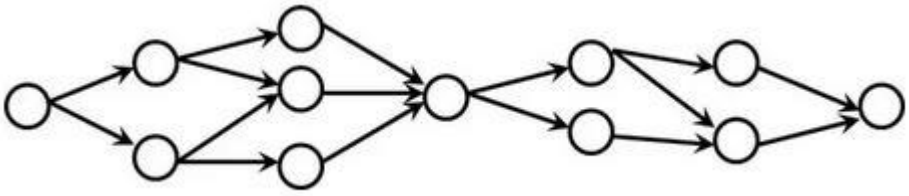

Figure 2.4 Parallel Narrative. Source: Game Design Concepts by Ian Schreiber(https://gamedesignconcepts.wordpress.com/)

Parallel paths overcome some of the challenges of producing a tightly branched narrative by reducing the total number of narrative sequences (Prosser, 2014). On one hand, this limits the options characteristic of the constrained branching narrative model, but still allows for a satisfactory level of choice for the user.

Also, Parallel Paths offer the player two distinct paths leading to "intersections" where narrative binaries combine. As described by *playwithlearning.com*, “this allows the user to experience the consequences of their choices, but takes them back to predetermined points where the story can advance in a well-defined manner. By jumping from one node to another in this way, the user assumes a high level of control even if his experience is shared in full with

that of many other players" (https://playwithlearning.com/2010/10/28/exploring-interactive-narrative-part-3/). For example, video games like *Syberia* allow to choose two options or approaches each time.

"Each option has a unique set of challenges and consequences, but the paths loop back together at key points in the game, allowing the user to either continue from there, or experience the consequences of choosing the alternative.

A further relevant point of this kind of narrative model is that it becomes possible, as illustrated by many products, to offer the user the choice between paths that will make the characters evolve through moral choices. This offers the opportunity to present alternative perspectives, capable of profoundly influencing the sensations of the gamer. In this regard, the concept of *replayability* assumes particular relevance, since the user's understanding of the environment as a whole will be improved as a result of experimenting with alternative approaches" (https://playwithlearning.com/2010/10/28/exploring-interactive-narrative-part-3/).

A third approach to nonlinear storytelling in video games is dynamic narrative. Generally, the narrative models described so far all have a common element: a predetermined ending. In these cases, the developers have more or less decided when and how the story ends. Dynamic narratives, on the other hand, offer users an object-oriented narrative; the possession or not of an object, in fact, becomes a key element to move from one narrative node to another, guiding the player along the different stages of the story, while leaving him free to explore the virtual scenarios (Prosser, 2014).

As a result, the game experience extends for as long as the player wishes. This is deducible from Figure 3.4.

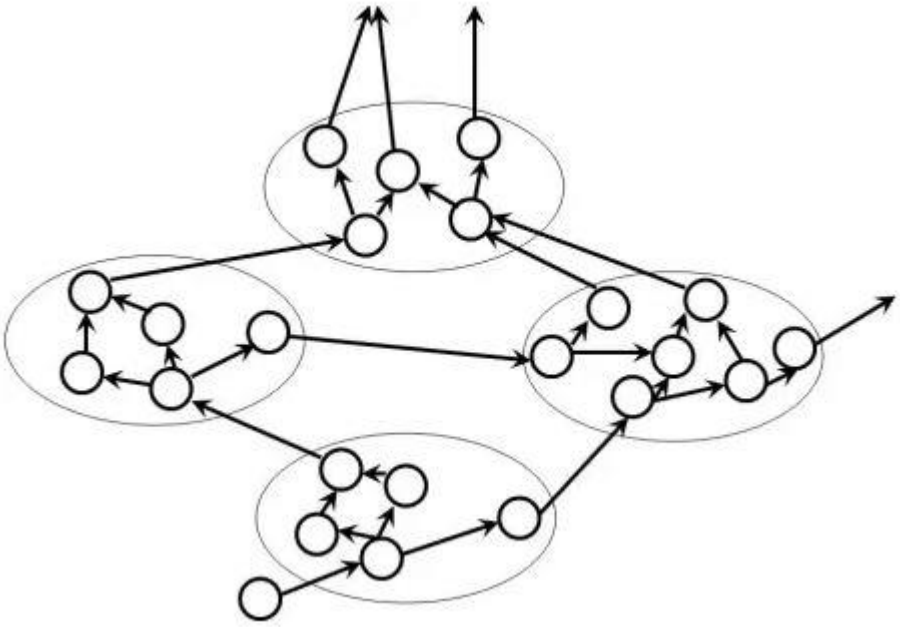

Figure 3.4 Dynamic Narrative. Source: Game Design Concepts by Ian Schreiber (https://gamedesignconcepts.wordpress.com).

“These dynamic experiences may contain relatively complex storylines (in the form of implicitly linked events), but have multiple connections to other event nodes embedded within them. This allows the user to build a narrative at will and in which the relationship between the characters or the revelation of the plot unfolds in an unpredictable way”, as described by *playwithlearning.com* (https://playwithlearning.com/2010/11/10/exploring-interactive-narrative-dynamic). This model potentially offers a high degree of customization of events and characters, since it opens the door to numerous optional elements. Naturally, all of this will tend to highlight the player's creative talents.

Playwithlearning.com states that “in games like *The Sims*, with no stated goals or a finite number of prepared events, there can be an implied or emergent narrative as the stories evolve out of a dynamic game environment. These "open" experiences develop a continuous story through the behavior and interactions of characters and contexts within the environment. The events that take place are entirely determined by the user's actions and the rules of the game world, and all this happens according to fixed algorithms, but conditioned by unpredictable actions” (https://playwithlearning.com/2010/11/10/exploring-interactive-narrative-dynamic).

Within these "endless stories" the user can play without any limits being placed on him, even if the failure to impose suitably structured objectives in some cases does not allow the user experience to reach a satisfactory narrative conclusion. For this reason, dynamic narration is better suited to some types of video games, such as management or *open world* (Prosser, 2014).

4.1.7 Videogames as reference media of nonlinear narrative

Since the narrative aspect appears to be closely linked to the gaming experience (Howells, 2002), the video game presents itself as the ideal reference medium for nonlinear narrative.

Referring to other media forms, the random rearrangement of elements is the basis of films such as *Memento* and *Pulp fiction*, or novels such as *To the lighthouse*, by Virginia Woolf. However, in traditional media the author determines the sequence. In these cases, each narrative sequence is provided with enough clues to simultaneously intrigue and tantalize the viewer, and these delicate interdependencies help reinforce the experience (Spierling, 2005).

Instead, within video games and the virtual environments that make up their essence, the user will take over the reins of the narrative, making the whole process more complex and multifaceted than in other media forms (Fassone, 2017; Teti, 2014).

Furthermore, since in the videogame each sequence will have to be developed and codified, each of the non-linear narration techniques described above will be subject to various variables, including the cost of the project, the videogame genre, etc...

Table 1.4 summarizes the characteristics of each narrative technique in relation to specific variables that define and imply the levels of effectiveness and the critical aspects.

Table 1.4 Narrative techniques main features.

Narrative technique	Narrative model	Game goals	Progression of events	Endings	Aumont of human and economic resources*	Game experience customization*
Branching narrative	Bound	Bound to the chosen path	Based on narrative paths	Multiple pre-determined endings	+++	+++
Parallel narrative	Bound	Bound	Based on pre-determined decision points	Pre-determined	++	++
Dynamic narrative	Not bound	Not defined	Free	Open/not defined	++++	++++

*The symbols shown have been conceived to exemplify a generic comparison relating to the different types of narrative techniques.

In addition to the elements of specific narrative techniques discussed above, non-linear interactive digital storytelling has further characteristics of digital storytelling. It allows for an expansion of the story universe through the use of a number of different media, all interconnected to serve the main story. Furthermore, it allows you to create deeply immersive experiences through the use of intelligent augmented reality techniques. As a result, new challenges arise for game designers to combine non-linear storytelling techniques and the most innovative multimedia resources to tell the story (Spierling, 2005).

Game studies have highlighted how the narrative component of a video game has assumed a very high level of relevance over time. Although the main peculiarity that defines the video game remains the interactive component (gameplay), this medium proves to be the ideal reference model for non-linear narration. Taking into consideration the most common non-linear narration techniques, it can be seen how they give added value to the gaming experience experienced by the user, consequently increasing the personal perception of control over events. As the narrative technique used varies, so do the degrees of personalization of the character and uniqueness of the experience, as well as the use of human

and economic resources. In particular, the combination of interactivity and nonlinear narration proves to be effective, defining the concept of interactive digital storytelling.

The non-linear narration techniques thus conceived within the video game tend to reach particularly high levels of entertainment, managing to involve the user more than what happens in other media forms.

4.1.8 Reference tools for nonlinear storytelling

As nonlinear storytelling is characterized by interrelations between different characters, locations and times, localizers have to deal with these additional items and parameters when they translate and adapt textual contents. In particular, these interrelations are more frequent in products linked to narrative universes proper of cross medial and transmedia franchises, where it is possible to find references to sub-plots, spin-offs etc.

These scenarios highlight the necessity to keep localizers involved into each specific project at least on a macroscopic level, providing them sufficient materials and information to properly achieve localization goals.

However, these materials and information could not be sufficient if not supported by specific tools aimed to help localizers to keep in mind important details about the narrative.

In this regard, this research would suggest a particular kind of software, already present in both open source and retail distribution channels, that could be adopted in game localization field. These specific products are aimed to create and manage timelines, making so possible to trace narrative nodes, times, locations and characters interactions.

By way of example, this study would mention two software aimed to create and manage timelines.

Twine, available at https://twinery.org/, is an open-source software that allows to create and export timelines in several formats; moreover, it can be possible to add some extensions to a

project, such as variables, conditional logic and pictures. Also, the software supports CSS and JavaScript.

Aeon Timeline (https://timeline.app/) is a retail product characterized by a smart and accessible GUI to create complex roadmaps, making possible to easily work with fictional universes.

Figure 4.4 provides an overview about how what the interface of the two mentioned software looks like.

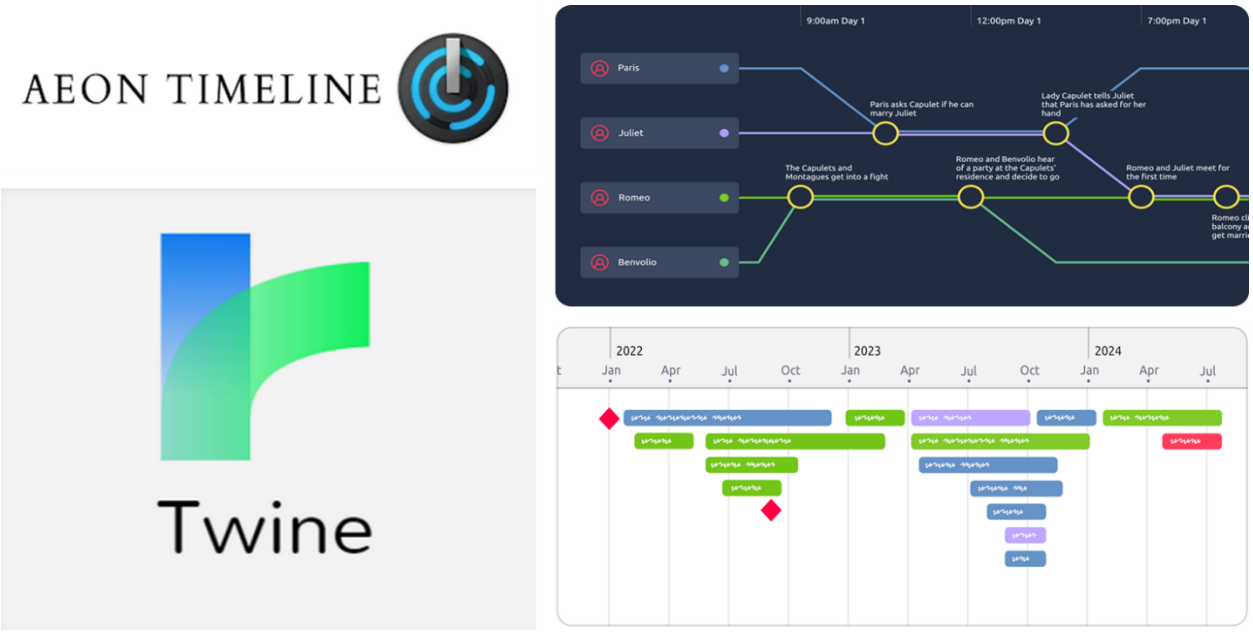

Figure 4.4 Storytelling management software that could be used in videogame localization workflows. Source: provided by the Author.

4.2 Game accessibility and localization strategies

Since the gaming industry continues to expand, even more additional features are integrated to products. In this regard, accessibility is undoubtedly one of the burning issues of the day. In particular, recognizing and addressing accessibility concerns not only improves the overall user experience, but also meets the ethical imperative to ensure that digital entertainment is accessible to everyone, regardless of their physical or cognitive abilities. Incorporating game accessibility principles into the development process can contribute to a more equitable and enjoyable gaming environment for all types of players.

Game accessibility and localization strategies are critical considerations in today's gaming industry to ensure that digital entertainment is inclusive and culturally relevant to a diverse global audience. In other words, accessibility involves designing games to accommodate individuals with varying abilities, including users with disabilities. This requires implementing dedicated features, such as customizable controls, subtitles, and options for colour-blind or visually impaired players. Localization, on the other hand, focuses on adapting games to different linguistic and cultural contexts, making them more accessible and relatable to players worldwide.

As an effective localization involves translating in-game text, voiceovers, and cultural references, it is strictly connected to accessibility features. Consequently, combining accessibility and localization strategies can significantly enhance the gaming experience for a broader spectrum of users, promoting a sense of inclusivity and cultural resonance.

In these scenarios, both game developers and publishers must prioritize these strategies to create games that transcend linguistic and physical barriers, providing an enriching experience for players worldwide (Pyae, 2018).

4.2.1 Localization for user interfaces

The user interface (UI) always represented a key element in the human-computer interaction. In fact, UI is present in a large variety of software developed for several kinds of devices, each one characterized for different hardware features and screen size.

Also, a UI is not a static infrastructure, but it dynamically changes depending on the requested or needed information to display.

In the field of video games and application software, localizers have to deal with the adaptation of graphics, symbols, and even gameplay elements to meet the cultural habits and expectations of diverse kinds of users. This not only enhances usability and accessibility, but also allows a deeper connection between the software and its users, contributing to increased user satisfaction and engagement.

Nielsen (2005), in his theory about the development of usable user interfaces, highlighted some fundamental principles to consider in designing an effective UI. These aspects are divided in three categories related to:

- **Human-computer interaction:** Nielsen reported that a synchronic relationship between the user and the machine is useful to keep the users informed about the software status and all the current tasks and operations. In this regard, the presence of progress indicators, loading animations and other related elements, is considered relevant in human-computer interaction. Also, it is necessary to use the appropriate linguistic registry, as much as possible in line with the specific understandability criteria meant for common users. In fact, using too technical expressions can lead to confusion.
- **Errors and mistakes prevention:** Nielsen stated the importance of creating and proposing confirmation options for all the most relevant operations and tasks. In this way, some errors and problem can be prevented. However, when some errors occur, the related informative message should be proposed using common text instead of the error code or numeric strings.

- **Subsidies for users:** Nielsen reported that a good UI does not need any supporting tool or guide for the software. The UI design should not be meant with the purpose to make necessary to consult long instructions. In this regard, an effective UI should have a simple and as much as possible intuitive structure.

In contrast to application software, the user interface of modern video games should be designed with even more accessibility and gameplay in mind. In addition, unlike software applications, video games require dynamic user interfaces that evolve and respond in real time to the changing game environment, player actions, and narrative progression.

This adaptability not only facilitates seamless integration into the game world, but also contributes to increased immersion and engagement. Dynamic UIs effectively communicate critical information to players through visually appealing and contextually relevant elements such as interactive maps, mission updates, and health indicators.

The integration of dynamic UI elements is particularly crucial in open-world and narrative-driven games, where the complexity and variability of the gaming environment demand interfaces that can efficiently convey information without overwhelming the player. Furthermore, dynamic UIs contribute to a sense of agency, allowing players to make informed decisions based on real-time feedback, thereby enhancing the overall player experience and fostering a deeper connection with the virtual world.

Eventually, video game developers and localizers have to deal with the necessity to adapt these dynamic UIs to the gameplay styles of users with disabilities. For example, blind or visually impaired players could count on specific and dynamic visual and audio aids designed to help them to better recognize the most relevant items on the screen and being informed about what is happening in the game. In this regard, UIs in video games are discussed in one of the case studies present in chapter 5.

As videogames continue to advance, the design and implementation of dynamic UIs remain a key area of research and innovation, ensuring that players are provided with intuitive, engaging, and adaptable interfaces that enhance the overall gaming experience.

4.2.2 Interactive text and sound

Interactive text and sound in video games are integral components that contribute to the immersive and dynamic nature of the gaming experience. The strategic integration of interactive text provides players with contextual information, narrative cues, and dialogue that dynamically respond to their actions and influence the narrative. These interactive text elements also allow players to shape the narrative paths through their choices, creating a personalized and player-driven experience. Similarly, the incorporation of interactive sounds further enriches the gaming environment in relationship with in-game events, player actions and the virtual landscape. Interactive sounds also contribute to create a sense of presence, providing proper auditory feedback, other than reinforcing the player's connection to the virtual world. The synergy between interactive texts and sounds in videogames underscores the importance of multisensory engagement, giving a more immersive and captivating gameplay experience that transcends traditional storytelling mediums.

Localizing interactive texts and sounds in videogames involves adapting them to different languages and cultural contexts while preserving the intended gaming experience. Below are reported some key considerations and strategies for handling interactive texts and sounds during the localization process (Bernal-Merino, 2014):

1. **Cultural Sensitivity:** It is important to understand cultural differences and avoid all those translations that may not give the intended meaning or humour in different languages. It is also necessary to adapt interactive text and sound to the specific cultural norms and references to ensure that the content will be considered acceptable by the target audience.

- **Text Expansion and Contraction:** Localizers should be aware of text variable dimensions when translating interactive text. In fact, some languages may need more space or fewer characters to communicate the same message, and this can affect both the layout and design of a user interface.

- **Localization of Sounds** Video game localizers should ensure that localized sounds are appropriate to the cultural context and preferences of the target audience. This may

involve replacing or reconstructing sounds with others that would result better in specific cultural scenarios.

1. **Voiceovers and Dubbing:** If the game includes voiceovers, it is important to preserve the emotional and cultural peculiarities of the original content. In other words, localizers should make sure that both the lip-sync and timing match the target languages.

- **Subtitle Placement:** The placement and timing of subtitles should be adapted to match the length of translated text, by ensuring that subtitles do not obscure important visual elements and interfere with the gameplay experience.

- **Testing and Iteration:** A proper testing involving native speakers should be conducted in order to identify languages, cultural elements and specific sounds. In this direction, Iterative testing and feedback are critical to obtain acceptable results.

1. **Maintaining Consistency:** Video game localizers should maintain consistency in several aspects of terminology, style, and tone in interactive text and sound, in order to to create an enjoyable gameplay experience. In this regard, consistency can help players to feel a sense of familiarity, even in different linguistic and cultural scenarios.

- **Considering Regional Differences:** Certain terms, expressions and sounds could be better accepted in specific Countries, so a high degree of customization related to regional preferences can improve the overall localization quality.

1. **Documentation for Localizers:** Localizers should be provided with detailed documentation about the game. In particular, this information should relate to the context, intended emotions, and narrative aspects associated with both interactive text and sounds. This should help localizers to make informed decisions during the whole localization process.

By carefully managing these aspects, both video game developers and localizers would be able to guarantee that interactive text and sounds are properly adapted for specific audiences, contributing to create an enjoyable and culturally resonant gameplay experience.

4.2.3 Localizing games for children

Localizing video games for children is a critical aspect of game development that involves adapting content in according to the cultural, linguistic, and age-specific preferences of young players in different countries.

Children have distinct cultural backgrounds and linguistic nuances that influence their understanding and engagement with video games. Therefore, effective localization takes into account not only language translation but also the incorporation of age-appropriate content, cultural references, and educational components that resonate with the target audience. Developers must also take into account local sensitivities and laws regarding children's content in order to create an inclusive and safe gaming environment.

In this context, the localization process should improve the accessibility features of video games intended for children, promoting both entertainment and educational value, while respecting the different contexts in which these young players live. In addition, children are exposed to a variety of texts before they have mastered literacy skills.

Mayoral (1988) stated that textual translation must take into account even non-linguistic elements, since they are not part of the meaning and can establish their own rules over the linguistic component. Because children are strongly influenced by non-linguistic elements, the localization of this type of product is a complex and delicate process.

In general, most videogames designed for children are inspired or taken from specific literary works already present in book and movies. Some examples are *Harry Potter's* video games (2001-2011) or many titles based on *Disney Pixar* movies, such as *The Incredibles* (2004) and *WALL•E* (2008).

Most videogame developers count on the fact that products based on literary or cinematic masterpieces tend to sell well. This generally happens because children feel encouraged to play a video game based on stories they have previously read in a book or watched in a movie. At the same time, many young users can sometimes play the video game in the first instance, for then accessing the original book or movie.

Furthermore, as the 2000s stated the passage from cross-media productions to transmedia storytelling (Jenkins, 2006), even video games developed for children began to differentiate from other media transpositions, proposing extra narrative contents, unique gameplay features etc (Bernal-Merino, 2009).

However, these video game adaptations of well-known literary works have to face more restrictions during the localization phase compared to other game genres. First, this happens because certain types of deviations may be perceived as a violation of the license agreement.

Another important element is linked to the ways in which the various content rating systems classify both textual and multimedia contents in relationship with the age of young players. While the game industry's internal rating boards have the authority to determine the suitability of a game for a particular audience, the various local laws have the authority to block the release of video games. Both *PEGI* (Pan European Game Information) and *ESRB* (Entertainment Software Rating Board) are widely recognized content rating systems, and their guidelines are generally followed by video game developers and importing countries. However, due to different customs and laws, individual countries reserve the prerogative to change the rating of a game or ban it outright if no changes are made. This variability in regulations means that a game may receive different ratings or distinct content depending on the country of release.

Today, video games have a significant influence on both children and young gamers in general, warranting serious attention from scholars. It is clear that a comprehensive approach involving multiple disciplines is essential to accurately examine the various characteristics and roles of each component within them. Game-like applications are increasingly utilized not only for educational purposes, but also for scrabbling into literary genres and narratives in ways unthinkable just a few decades back.

4.2.4 Players with physical and cognitive disabilities

Today, video game industry is concerned in creating even more popular and inclusive products. In this scenario, people who live with disabilities seem to like video games very

much. According *Accessibility.com* (https://www.accessibility.com/blog/the-state-of-accessibility-in-gaming-in-2021) players with disabilities represents almost 20% of the entire gaming community.

Developing video games for these users requires a holistic approach implementing accessibility solutions into every step of the video game development process. In particular, starting with both the designing and conceptualization phases, video game developers should focus on inclusivity, identifying the various degrees of abilities and needs required by the target audience.

This requires extensive research and feedback from people with disabilities and accessibility experts to identify potential barriers and opportunities for improvement. During the design phase, video game developers should focus on creating accessible user interfaces, customizable control options, and adaptable gameplay mechanics designed for different physical and cognitive abilities. Incorporating features such as adjustable difficulty levels, alternative input methods, and clear audiovisual aids can enhance accessibility without compromising the main gameplay experience. In addition, testing prototypes with people with disabilities and soliciting feedback throughout the development cycle is critical to identifying and properly addressing accessibility issues. By looking at accessibility as a fundamental aspect of game design, video game developers can create more inclusive gaming experiences that allow people with disabilities to fully experience and enjoy their products.

Video game localization for people with disabilities is also a multifaceted and complex process aimed at providing full access to game experiences for people with varying physical and cognitive abilities. In other words, this process involves a comprehensive approach related to several aspects of game design, interface, and content to remove barriers and provide inclusivity.

In these scenarios, localization processes should be physically accessible and focus on adapting game controls and mechanics to accommodate various mobility impairments. This can include customizable control schemes, alternative input methods, such as gesture control or voice commands, and compatibility with specialized hardware like adaptive controllers. Moreover,

tactile feedback and special audio aids can provide all the relevant information about the game to players who may have some difficulty with visual stimuli.

Moreover, localization should also be cognitively accessible, emphasizing clearness in user interfaces, instructions, and game mechanics. This may involve the development process, providing adaptable difficult levels, intuitive menu navigation, and specific customizations of gameplay elements to set individual preferences. In addition, the use of subtitles or alternative texts (Liubinienė, & Šiaučiūnė, 2011) should ensure a full engagement with narrative and dialogues for users with hearing impairments. An effective collaboration with professionals and experts in accessibility field should also create a bond with the gaming community, with the purpose to collect some relevant feedback and insights, which can contribute in the localization process.

By prioritizing accessibility in both game design and localization phases, developers can create more inclusive gaming experiences aimed to satisfy the diverse needs and preferences of players with disabilities, promoting a more welcoming and inclusive gaming community.

4.2.5 Gender question in game localization

As game localization involves adapting video games for different regions and cultures, it should ensure that game contents are properly translated, other than culturally relevant (Salvador, 2015).

In recent years, a crucial aspect of this process has been related to gender representation and inclusivity. This includes questioning and modifying language with the purpose to be more inclusive and respectful of all genders. By employing inclusive language, game developers can create a more inclusive and representative virtual and social environment for players of diverse backgrounds. This practice extends beyond translation affecting character design, narrative choices, and gameplay mechanics.

The character design is perhaps the most relevant aspect tied to gender and inclusive language. In fact, digital avatars, in their essence, offer a dynamic platform for self-expression

and interaction within virtual spaces, involving both psychological and sociological aspects (Lankoski & Björk, 2007; Schembri, 2003). However, today the sexual gender is no longer expression of the exterior aspect in digital characters; consequently, the main elements which are responsible to express a specific gender are texts. This means that game localizers have to deal with complex situations, as they have to manage and adapt long textual portions, even in relationship with several features proper of diverse nonlinear storytelling techniques, such as branching or dynamic narratives.

Providing inclusive language in these situations can be difficult, as there is the need of adopting specific linguistic strategies, such as the use of gender-neutral pronouns and culturally sensitive lexicon. In fact, in modern digital narrative structures, it is important to maintain consistency in language usage when dealing with different narrative paths. One of the main issues lies in ensuring that inclusive language choices remain coherent and contextually appropriate throughout various gameplay scenarios, considering both the character development and cultural aspects. In addition, accommodating diverse identities and experiences within the constraints of localization can be complex, requiring a high level of attention to detail and sensitivity to avoid perpetuating stereotypes or inadvertently excluding certain relevant items. Balancing inclusivity with the original creative vision of the game while navigating linguistic and cultural differences, can also complicates the localization process. In consequence, effectively integrating inclusive language into nonlinear narrative video game localization necessitates an approach that prioritizes authenticity, representation, and respect for diverse perspectives.

In this regard, *GLOS International Localization School* (https://www.gameslocalizationschool .com/en/videogame-localization-bugs/), claims that, “in addition to the common issues and bugs tied to the development process of modern video games, other kinds of technical problems related to texts can happen, and they are known as localization bugs”. The number of these kinds of bugs can vary depending on the product and other factors, such as the narrative scheme or the game genre. In the case of the biggest productions, such as modern open-world Role Playing Games, the potential number of localization bugs can be very high. Here, the localizers have the role to identify the cause of the bugs and report it to programmers, which would be able to fix the issues.

However, in order to make this process more efficient and faster, it is necessary to find new ways of working and to provide localizers and other professionals in the localization industry with new IT tools. One way to do this is to use specialized programming languages to quickly fix localization bugs and properly implement the inclusive language. Even though it is not explicitly required that localizers have programming skills, knowing the main characteristics and dynamics of these would be an added value in order to better communicate with programmers and developers and to allow for a more systematic collaboration between them, especially in the early stages of software and video game development. Furthermore, programming languages could also help to perform localization in a faster way. As the most common programming languages adopted in video game development (for example *C++, C#, Swift or JavaScript*) are not so easy to learn for beginners, an acceptable solution would be to look for more accessible tools, which would be closer to natural language. Among these, Python could represent an acceptable solution to learn the basic dynamics of programming, with also the possibility to integrate machine translation engines. Further details about this will be discussed in chapter 5.

4.2.6 Game accessibility and low-resourced languages: crowdsourcing in video game localization

As stated in chapter 1, accessibility and usability of digital products in localization extend beyond major and most common languages to comprehend low-resourced languages as well. These kinds of languages, often spoken by little communities, have to deal with significant obstacles and barriers in accessing digital products. This mainly happens due to low localization efforts and limited economic resources.

By promoting the support of low-resourced languages in game localization industry, there is the need to ensure that the highest possible number of individuals can have access to digital interactive resources, promoting inclusivity worldwide. Also, accessibility not only enlarge the

reach of digital content, but can contribute in preserving linguistic and verbal varieties and cultural identities.

This requires the involvement of native translators, as working with CAT tools and AI-driven tools when dealing with low-resourced languages could lead to localization issues caused by missing characters and translation tag errors. (Skadiņš; Pinnis; Vasiļjevs; Skadiņa; Hudik, 2014). Native translators and other professional profiles can be hired by companies through *crowdsourcing* practices (Estellés-Arolas et al., 2015), which in game localization refers to the practice of engaging a varied and decentralized group of experts, professionals or fans, such as bilingual speakers, localizers, gamers, and enthusiasts, with the purpose to localize and adapt game content into multiple languages. In this way it is possible to exploit the skills and the cultural expertise of the crowd to overcome the open challenges related with linguistic variety and resource constraints in game localization tasks.

Unlike traditional localization methods that mainly rely on professional translators and linguistic experts, crowdsourcing adopts a global approach, as often individuals coming from different linguistic backgrounds are happy to contribute with their skills and knowledge to the localization process (Estellés-Arolas et al., 2015).

Moreover, the adoption of crowdsourcing in video game localization provides several advantages, such as increased scalability, cost reduction, and quicker turnaround times, as it offers the access to a variety of resources distributed across different geographical areas and communities (Estellés-Arolas et al., 2015). Then, crowdsourcing stimulates community engagement and empowerment by allowing gamers and enthusiasts to actively contribute in shaping the whole gaming experience of a product.

However, crowdsourcing also presents issues and open challenges. For example, ensuring localization quality while collecting these contributions it is not easy, as there is the need to maintain a certain grade of consistency across multiple language versions of a product. In spite of these open challenges, crowdsourcing is emerging as a valuable strategy in video game localization, by allowing developers and publishers to build an environment where audiovisual adaptations can be constantly adjusted and improved, considered the continuous feedback collected by user community.

Summary

Both creativity and accessibility have proven themselves two fundamental aspects of localization. Behind the development and cultural adaptation of modern digital products, localizers have to deal with a multitude of technical questions and peculiar issues and challenges, especially in the case of video games.

Firstly, the role of modern professionals in this area is part of a complex and varied scenario, where IT technologies are revolutionizing the way in which a product is linguistically and culturally adapted, creating new ways to operate and co-operate. As today machine translation-based tools are widely used, localizers are assuming even more a role of supervisors and quality checkers of audiovisual texts. In this regard, the essential concept of creativity has changed as it is affected by many aspects: first of all, due to a radical transformation of authorship distribution (divided between film companies, publishing and software houses etc.), video game companies often receive detailed instructions about the use of creativity in localization processes. Then, even marketing strategies affects localization tasks, introducing peculiar mechanics of transcreation applied to specific texts in different market scenarios, such as humoristic and idiomatic expressions or characters names. Eventually, the various nonlinear narrative structures (branching, parallel and dynamic) adopted in video games can imply certain creativity grades and methods that could be applied to texts, and content rating systems (PEGI, ESRB) provide precise indicators for localizers with the purpose to make games even more enjoyable to people of all ages.

Accessibility represents another crucial factor that defines the work of game localization. Today many features of interactive digital products have evolved, and modern professionals of translation and localization have to consider new elements during their tasks, such as dynamic user interfaces, interactive texts and sounds, even considering all kinds of players, including users with disabilities, elderly players and novices. In this regard, game localization begins to affect the whole gameplay experience, providing audiovisual aids, alternative narration systems that interact with control mapping and many other strategies to make games enjoyable by large audiences.

Then, both gender gap and inclusivity have to be considered. As today gender expression is no more tied to character's exterior aspect, the gender identification is mainly related to textual elements; game localizers have to deal with them, considering also that modern video games present nonlinear texts. In this regard, certain programming languages and other IT tools can come in help during the linguistic and cultural adaptations.

In order to better discuss both creativity and accessibility in practical operating contexts, in chapter 5 will be presented three case studies that explore and these concepts suggesting some appliable methodologies to highlight new possible paths to satisfy the modern needs of localization industry.

Chapter 5. Case studies

Introduction

This section has been developed in parallel with chapter 4, and comprehends both the theoretical and methodological basis established in all the previous sections of the thesis. In particular, three videogames belonging to diverse genres will be analyzed. Each product has been selected for its specific localization challenges and features. These contributions, characterized by study approaches, will be presented as stand-alone manuscripts, as the they have been submitted to specific selected journals. They provide practical examples of the operational ways adopted by localization teams when facing the technical, linguistic, and cultural obstacles during their work.

The products that have been selected are: *Mario Kart 8 Deluxe* (Nintendo, 2017), *Cyberpunk 2077* (CD Projekt RED, 2020) and *Monkey Island* saga (Lucasfilm Games and Telltale Games, 1990-2022).

Each case study will be followed by some specific applicative proposals, including tools and strategies aimed at improving the localization process. Among the main topics and trends, the case studies would explore the potential of AI-driven technologies such as machine learning and machine translation, which are aimed at automatizing specific localization phases, especially in the management of large text portions characterized by cultural sensitivities.

Moreover, a large variety of issues and challenges that could affect modern localization practices will be highlighted. In this regard, creativeness would assume a relevant role, particularly in those products characterized by nonlinear narrative, where translation should be aimed at evoking emotions while maintaining coherence with the original story.

In conclusion, the analyzed products will report specific issues related with accessibility and gender gap themes. About accessibility, modern localization practices would consider how to create accessible digital products suitable by players with disabilities, including visual, auditory, or cognitive impairments. Then, the representation of sexual identity in video games questioned the concepts of inclusivity and diversity, which are becoming relevant components of ethical localization processes.

5.1 Localization and accessibility in racing games: the case of Mario Kart 8

The case study focuses on the role and interdependency of localization strategies and accessibility features in modern inclusive arcade and simcade racing games, aiming at attracting even casual players or players with disabilities. Starting by giving an overview about the origin, the evolution and the differentiations of racing games, this paper presents a specific case study based on the analysis of Mario Kart 8/Mario Kart 8 Deluxe, here identified as a reference product in terms of inclusiveness. By examining the ways how localization is approached in the game, the analysis discusses its impact on static and dynamic user interfaces and audiovisual aids, highlighting how localization strategies can interact with control systems and driving aids. The study also aims to identify new trends followed in the development of newer games, by defining a path where localization and accessibility will together become part of the vehicles driving model, making products even more inclusive and characterized by a higher overall quality.

Moreover, the study identifies some further investigation areas through which it should be possible to collect some relevant quantitative data aimed to support this initial investigation, also contributing in facing future challenges.

5.1.1 Description and methodology

The localization of digital products is constantly evolving and changing. Born as a branch of software engineering, localization is now considered a new form of translation (O'Hagan, 2016).

In videogames, a common thought to intend localization is to associate it to the narrative aspects and specific in-game texts, such as subtitles and other descriptions.

Whether this concept can be related to a large portion of game genres (i.e., action/adventure, role-playing, etc.), there are others where localization is performed in a different way. In this regard, racing games represent a genre with a particular balance between gameplay and narrative elements. In fact, in racing games the narrative component

is often reduced, or even completely absent.

In addition, another important aspect to consider today in video games in general, and in racing games in particular, is accessibility. As in all kinds of racing game subgenres (i.e., arcade, simulation or "simcade") the gameplay experience is considered the primary component of the product. In other words, the skills and abilities of players are relevant to achieve the game objectives.

Whether in story-driven products localization is meant in a specific way, when it comes to racing games, it should represent a meeting point between multiple on- screen/audio information and accessibility features.

The study aims to analyze how localization techniques and accessibility features are integrated in modern racing games, even with the purpose to study the current ways to deal with the main issues and challenges proper of our times, trying also to contribute identifying some new directions for future trends.

The study uses a case study approach, focusing on a specific product. The selected videogame is *Mario Kart 8,* the last incarnation of the *Mario Kart* saga by Nintendo, released for *Nintendo WiiU* and *Nintendo Switch* (2017). This successful game proposes a peculiar approach in how localization techniques and accessibility features have been implemented, becoming a reference point for modern arcade racing games.

Starting by making an overview about the most common racing game types in Section 5.1.2, the study analyzes how the *Mario Kart* saga evolved over time until the release of *Mario Kart 8* and *Mario Kart 8 Deluxe*, describing also the main methodologies used by developers and localizers to make the game enjoyable and inclusive for different types of players, such as children and people with disabilities.

From these considerations, new future trends are identified in Section 5.1.5, even in relationship to more recent (and in development) games.

5.1.2 Racing games: typologies and features

Today, racing games are related to a complex and multifaceted environment composed of different subgenres and styles. This has been made possible by technological advances and the involvement of different types of human resources.

However, the birth of racing games dates back to the 70s. In fact, it is possible to speak about this genre only in 1973, when *Space Race* was released by *Atari* and distributed by *Midway*in arcade playrooms.

Released after *Pong*, *Space Race* was the second product launched by Atari. The videogame concept was very simple: two players have to race each other moving their own spaceship up and down on the screen across a star field, trying to avoid asteroids which randomly appear coming across from left to right. The control system allowed only two directions and the entire game was based on moving a bunch of pixels on the screen, but at that time the sole graphical aspect of the object and sprites was enough to define a video game genre.

As technology made it possible to develop better and more powerful hardware over time, video game genres began to present more differences and specifics in their structure and style. In 1975, the creator of *Space Invaders*, Tomohiro Nishikado, developed *Wheels*, a top-down racing game that adopted a real steering wheel as a control system. The hardware also included a gearshift and accelerator/brake pedals.

In this regard, Williams (2014) found that a good sense of control can increase flow and enjoyment. In fact, although the car movements were limited to 2 axes (x and y) and the game shared the same basic structure of *Space Invaders*, the use of a dedicated control device represented a turning point in the development of racing games.

A further step was the implementation of a third axis (z) to allow the creation of simil-3D environments, enabling even more complex and realistic control systems and movements.

In this regard, *Night Driver* (1976), produced by Atari, was the first racing game with a dedicated structure and a first-person visual mode. Also, the immersive gameplay gave for the first time a realistic driving model. In other words, *Night Driver* could be considered the first racing simulation.

Due to hardware limitations, video games until the 80's were characterized by the absence of aesthetic elements except those relevant to gameplay. This happened especially in racing games, where only the cars and the road lines were displayed.

Pole Position by *Atari* (1982) and *Outrun* from *Sega* (1986) established new graphic standards, characterized by colorful and detailed landscapes. Also, newer home consoles such as *Nintendo Entertainment System* and *Sega Master System*, or personal computers such as *Commodore*

64 and *ZX Spectrum*, allowed similar experiences to be enjoyed from home..

From the middle and the end of 80s, the genre was ready for differentiations and new subgenres. *Hang-on* from *Sega* (1985) was a successful motorbike game, which also had a superbike representation as control system. *RC pro Am*, produced by *Rare* in 1988, presented racing competitions with radio-controlled cars, characterized by an isometric graphic. These games represented only two examples of a big variety of products realized with different graphic and technical structures.

After this period, racing games evolution increased overwhelmingly until present time. The advent Polygonal 3D graphics allowed more accurate models and better textures, while the increasing power of CPUs and GPUs made possible to implement dedicated physical engines capable of simulating a large number of parameters, such as handling, tyre consumption, collisions and damage systems.

Considering all this, software houses had the possibilities to create videogames aimed at specific type of players. As a result, racing games are now classified by according to the minimum skills required to play them.

Weber (2020) defines the term *sim racing* to describe all those racing videogames characterized for the best possible degree of realism compared to real world competitions, including also online multiplayer racing. Some modern examples can be *Automobilista* (2015) developed by *Reiza Studios*, or *iRacing* (2008) from *iracing.com Motorsport Simulation.* This type of products is designed for experienced players or even professional drivers.

On the opposite front, there are arcade and casual racing games, characterized for their accessibility to a high number of users due to the low skills required to play and enjoy the game. These products often point to a high usage of special effects with the purpose to increase the sensation of speed, colorful or stylish graphics and sometimes the presence of weapons and power-ups. *Mario Kart* saga (1992-2017) is one of the most representative examples of this subgenre. Also, *Ridge Racer* (1993) by *Namco* and *Crazy Taxy* (1999) from *Sega* attracted and enjoyed players worldwide.

Almost in the middle between *simracing* and *casual/arcade* racing games are *simcade* games, which are characterized by a balanced driving model. In fact, video games such as *Forza Motorsport* Saga, developed by *Turn 10 Studios* (2005-2023) or *Grid* saga by *Codemasters*

(2008-2022) presented a driving mode with a certain dose of realism, but with a certain degree of tolerance for driving errors.

Scacchi (2018) observed that sim racing products often require high-end hardware and specific dedicated peripherals, making these games designed for a limited target of users. Therefore, the paper will mainly focus on casual/arcade racing games, with also considering simcade, as they are also designed to attract global players.

The next section would describe some major relevant aspects about the various episodes of the *Mario Kart* Saga, outlining the main ideas about how these games were conceived and realized.

5.1.2 Mario Kart: chronicles of a fun for all racing saga

The first episode of Mario Kart saga for home consoles was released by Nintendo in 1992 for their 16-bit home console, the *Super Nintendo Entertainment System* (SNES). The idea behind Mario Kart was to develop an accessible multiplayer racing game with a simil-3D graphics. As the title was initially meant to be a classic racing game, the driving model remains still today more realistic than all the other sequels, as it was created by studying real go-karts behavior in tracks. Also, the same races are not too much affected by the use of power-ups and vehicles were easy to handle.

Despite its simple base concept, Mario Kart invented a peculiar subsection of arcade racing games, characterized by the presence of tiny and funny characters. In particular, it was possible to play in the shoes of all the main heroes and villains created by Nintendo, such as Luigi, Koopa, Donkey Kong, Bowser and others. As this game concept attracted all kind of players, many other software houses created their own titles based on the same structure. Some examples are *Crash Team Racing* (1999) developed by *Naughty Dog,* and *Sonic All Stars Racing* (2010) from *Sega* and *Feral Interactive.*

Considered the great success achieved from Mario Kart, Nintendo decided to continue to follow this path by releasing a newer game. As meanwhile home console hardware evolved, 1996 was the release year of *Mario Kart 64* for *Nintendo 64.*

Although the newer 64-bit console allowed fully polygonal 3D environments, the game

adopted a sort of hybrid mode, showing some compromises to maintain acceptable performance levels. In particular, all tracks are polygonal, while vehicles and characters were realized in pre-rendered graphics.

Unlike the previous game, Mario 64 driving model was based this time on radio- controlled cars, making vehicles easier to manage. However, if in Mario Kart power-ups played a secondary role on gameplay, Mario Kart 64 uses them as a key aspect of the game. In fact, the level of competition is more based in the ability to choose and use weapons, rather than in driving skills. This highlights an evident turning point of the saga, with the purpose to attract the highest number of players, including users not necessarily concerned on racing games, such as casual gamers or children.

Moreover, Nintendo started to promote a local multiplayer experience aimed to also involve family members and friends, building the basis to improve the concept when online technologies/infrastructures would allow it.

Meanwhile, the advent of *Nintendo Gamecube* made possible the release of the first Mario Kart videogame characterized by a stunning, fully polygonal 3D graphics. *Mario Kart Double Dash* (2003) presented some new concept and gameplay features, with the presence of two characters for every single vehicle. The characters are controlled by two players, each one with a different role; one of them drives the vehicle, while the other one is responsible to use weapons. Although this new concept represented an interesting innovation, the game suffered of a bad implementation of the power up management system, which negatively affected the gameplay structure. Also, due to the bad success of the game, Nintendo decided to abandon this concept in the newer titles.

In fact, in *Mario Kart Wii*, released in 2008 for *Nintendo Wii,* the gameplay structure retraced his steps, by proposing a simpler gameplay structure but with the implementation of some newer features allowed by the console. With the use of a control system based on motion sensors and online multiplayer support, the title became a blockbuster and a killer application.

By involving players of all ages worldwide, Mario Kart Wii became a symbol of fun for all and inclusiveness. Also, even if localization added the support for more language over time, in the previous games of the saga it was mainly concerned on game menus and user interface, but

here it was extended with the support of a short message system for online multiplayer. Each short message could be sent by pressing a button, in order to communicate some relevant information to other players.

On the way of the success of Mario Kart Wii, Nintendo developed the last chapter of the saga, which came out for *Nintendo WiiU* in 2014. Although the console didn't have a lot of success, *Mario Kart 8* is now considered the apex of the saga. If in a certain way Nintendo basically adopted a "more of the same" strategy, by adding more characters and tracks maintaining the basis of driving model, Mario Kart 8 saw some innovative changes in about all the relevant aspects of the game. Under gameplay structure, now tracks are built considering gravity variations, while the game presented some peculiar accessibility and localization features, that will be highlighted in Section 3. However, the videogame was reproposed in 2017 for *Nintendo Switch,* under the name of *Mario Kart 8 Deluxe.* The Nintendo Switch edition presented some minor differences and improvements, including new vehicles, a DLC with new tracks, and some new battle modes.

In conclusion, the Mario Kart saga offered other games developed for Nintendo mobile consoles, based on exemplified gameplay experiences directly deriving from the various reference home consoles.

The games are *Mario Kart Super Circuit*, released for *Game Boy Advance* in 2001; *Mario Kart Ds* (2005) for *Nintendo DS;* Mario Kart 7 (2011) for *Nintendo 3DS.*

In the same way as the home console versions, the Mario Kart mobile games strongly contributed to spread the saga worldwide, making Mario Kart a social phenomenon.

5.1.3 Mario Kart 8: Gameplay and localization among visual aids, in-game symbols and sounds

As mentioned in Section 2.1, Mario Kart 8 was released in two different times for two different consoles, with some minor differences. The game counts over 50 million of copies divided between Nintendo WiiU and Nintendo Switch.

Considering that both editions of the game share the same driving model other than comparable control systems, the paper mainly focuses on the Nintendo Switch version, as Switch is, at the moment, Nintendo latest console.

The hybrid nature of Nintendo Switch, aimed to be considered a mobile and home console at

the same time, made possible to converge Mario Kart saga on a single versatile device with different modes of use.

The videogame offers several game modes to choose from, such as single race, time attack, tournament, and battle race. Also, there is the support for online multiplayer for one or two players on the same console, and local multiplayer up to four players.

At the time of the game was released the supported languages were English, Japanese, Italian, German, French, Russian, Dutch, Spanish, and Portuguese. Other languages, such as Korean, Chinese and simplified Chinese have been added over time through a game patch.

Mario Kart 8 localization regards game menus, Head-Up Display interface (HUD) and the entire online subsection of the game.

As it happens in most part of racing games, localization process it is not aimed for narrative purposes. In fact, in both arcade and simcade racing games there is a strong interrelation between language, accessibility and gameplay, here related to driving experience. This regard, a first relevant aspect to consider about racing games is the fast pace action. In the specific case of Mario Kart 8, the gameplay experience is based on a high level of action phases which require adequate reflexes and specific skills to the players. Moreover, the framerate is capped to 60 fps, which is considered today a sort of minimum standard for racing games. In fact, lower frame rates can cause some delay in control responsiveness and in speed perception, and this can negatively affect the gameplay experience. This regard, Bowman et al. (2017) stated that game controller intuitiveness can be perceived in different ways depending on different factors.

In this context, in-game texts, symbols and also specific sound effects must have the function to quickly provide to the players all the information ad aids they needs without distracting them. The localization process on Mario Kart 8 is based on a minimalist approach, with the main purpose to assume a role of support for relevant symbols and sounds, other than specific accessibility features. In other words, the videogame uses a hybrid user interface, composed of static and dynamic elements.

In particular, in HUD all the relevant information, such as the race position and active power-ups/weapons, is static and disposed among the corners of the screen, with the track map (removable) that appears in semi transparency in the right-central area. This choice was

made with the purpose to maintain players focused on the race. However, there are also specific dynamic elements that will occur in particular situations.

In the first place, some visual effects represent relevant information and aids for the player. For example, when drifting, sparks appear in three different colors, each one meant to indicate the grade of speed amount after the bends. Also, draft effect can be visually recognized representing the wind blowing as outcome. These visual effects are associated to specific sounds providing multimodal feedback to the user, in order to make a situation even more recognizable. Localization process was directly involved in this concept, as each one of these situations was dubbed with specific vocal expressions (at least a dedicated one for every character) synchronized with the mentioned visual and sound effects. In particular, voices are dubbed in English, with also some onomatopoeic expressions. Providing a multimodal interface that allows adapting the interaction to the context and user profile makes the videogame more accessible (Caschera et al., 2015).

This hybrid multimodal user interface has been enriched with the presence of other accessibility elements linked with control systems. In particular, developers implemented a driving assist mode in Mario Kart 8. This option was meant to help players to maintain the vehicle on the track. In this way, it is possible to avoid the grass and obstacles, and fall out of the track. When the mode is active, a little antenna will appear on the vehicle, showing a yellow light that indicate when the aid work (e.g., when the vehicle is going out of the track). Also, the game incorporates an auto- acceleration mode which allow to avoid pressing the accelerator button.

Eventually, in addition to traditional control approaches, it is possible to use motion sensors and gyroscope for steering. It is possible to activate/deactivate these options before a racing session or through the pause menu. This regard, each option is identified with a symbol and a synthetic description. Although these descriptions are localized by using short terms and locutions, the game presents some issues related to character limitations. In videogame localization area, this aspect is highlighted by O'Hagan & Mangiron (2006). For example, in Figure 1.5 it can be possible to state the presence of abbreviations in the Italian version.

Figure.1.5 Example of abbreviations due to character limitations. Source: provided by the Author.

As Mario Kart 8 does not shows a high usage of transcreation, localizers had to try to reduce issues with abbreviations or simplifying some sentences for certain languages. This is particularly evident in online multiplayer section, where auto-messages appear short and schematic. In contraposition to this, Paye (2018) underlines the importance of an adequate level of culturalization in localization of digital products.

As mentioned before, Mario Kart 8 was developed by building an immersive environment in which all the main aspects are related each other to offer an accessible and inclusive experience. This considered, developers focused on giving to all kinds of players the possibility to win a race. For example, if the use of steering aid could give some advantages, it will also penalize players with a less amount of speed when drifting, making also more difficult to take shortcuts. Moreover, the weapons and power-ups system were built with the purpose to maintain a short gap among the players, by giving more powerful items to players with a bad race position.

This concept of balance allows to help specific kinds of players to be competitive in single and multiplayer modes. For example, players affected by color blindness can rely on sound aids and voices, while deaf users can dispose of visual aids and a functional visual interface. Also, rookies, children and people with coordination problems can be competitive and enjoy the game through steering aid and tilt controls.

Mario Kart 8 supports various types of control devices. It is possible to play using Joy-cons, gamepads and accessories like steering wheels or *Nintendo Labo* system. Figure 2.5 shows in detail some of the supported peripherals with the related button mappings.

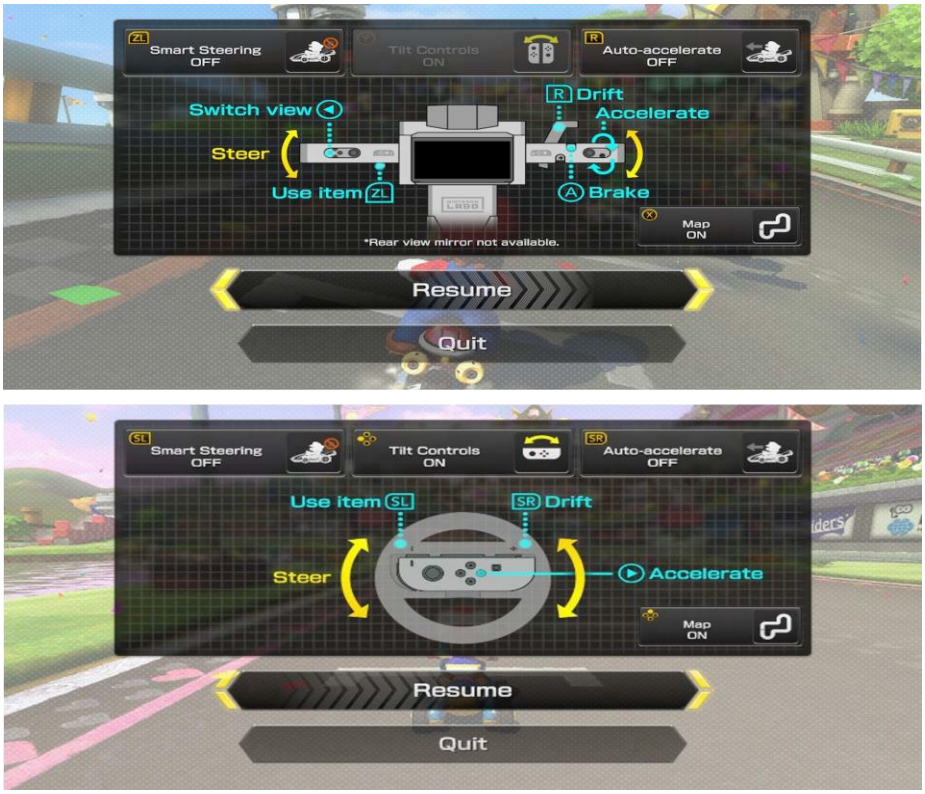

Figure. 2.5 Examples of button mappings for supported peripherals. Source: provided by the Author.

Mario Kart 8 does not give to the user the possibility to customize controls. In one hand, this could create some problems to players, and in particular to all those have specific disabilities and needs, which would prefer a more naturally mapped peripheral. On the other hand, this approach can raise the level of challenge forcing players to adapt to specific control systems. In this regard, Limperos et al. (2011) reported that naturally mapped peripherals could reduce the level of enjoyment, but McEwan et al. (2012) stated the opposite. Considered that the game is aimed for every kind of players, further studies could be conducted in this direction. However, Mario Kart 8 can be undoubtedly considered a contemporary reference point in future studies and in the development of newer arcade or simcade racing games. This considered, further reflections are provided in Section 5.1.4.

5.1.4 Adapting arcade and simcade racing games for global players, from disabilities to social inclusion

In the context of racing games and videogames in general, Mario Kart saga represented a symbol of inclusiveness and accessibility. The evolution of its main features reached the maximum

expression in Mario Kart 8 and Mario Kart 8 Deluxe, where it is possible to observe a deep interrelation among accessibility, gameplay experience, and localization aspects.

Moreover, although not all specifically designed for this purpose, some Mario Kart 8 features allowed players affected by different kinds of disabilities to enjoy the game and to be competitive in both single and multiplayer modes.

Starting from the proposed case study on Mario Kart 8, some reflections about new trends in racing games localization and accessibility are provided in this section, along with some considerations about specific solutions that are or could be implemented in future and in-development arcade and simcade racing games.

In this regard, a first relevant point to consider is the hybrid user interface adopted in Mario Kart 8. Both dynamic visual and sound aids certainly represent crucial starting items useful for development of future games. For example, Turn 10 Studios announced the presence of several innovative accessibility options available in their new Forza Motorsport episode, released in October 10, 2023.

In particular, the game will make some improvements in respect to Mario Kart 8, coming out with a new built-in system, known as *Blind Driving Assist* (BDA). This feature will allow blind and visually impaired people to play the game. By counting on a conspicuous number of audio descriptions and specific additional sounds to be keep updated about a high number of situations that happen on the screen during races, this kind of players could enjoy the game improving also their performance, such as personal best laps and race positions. BDA will also give information about the position and orientation of the vehicle on the track, or about the suggested gear and speed for turns and chicanes. All these aids will be managed by a preview system designed to anticipate all the information, allowing players to react in time.

Forza Motorsport will also implement other two relevant features, known as *One Touch Driving* and *Screen Narrator.* The first system is a driving assist mode that allows players to select a preferred combination of driving aids, including also the number of buttons to use other than their complete customization. Instead, Screen Narrator is a localization feature based on the audio description of game menus and user interface, allowing the player to decide the preferred number of information to receive.

All this considered, it is possible to observe some main directions followed by software

houses in relationship with future and in-development products. Also, it can be identified new trends where visual and audio localization in racing games could now be integrated in both control systems and driving models, with a relationship of interdependency. In this way, localization would go beyond its usual informative and narrative role, becoming also an active component of the entire gameplay experience. Figure 3.5 presents a proposed diagram aimed to better describe this relationship.

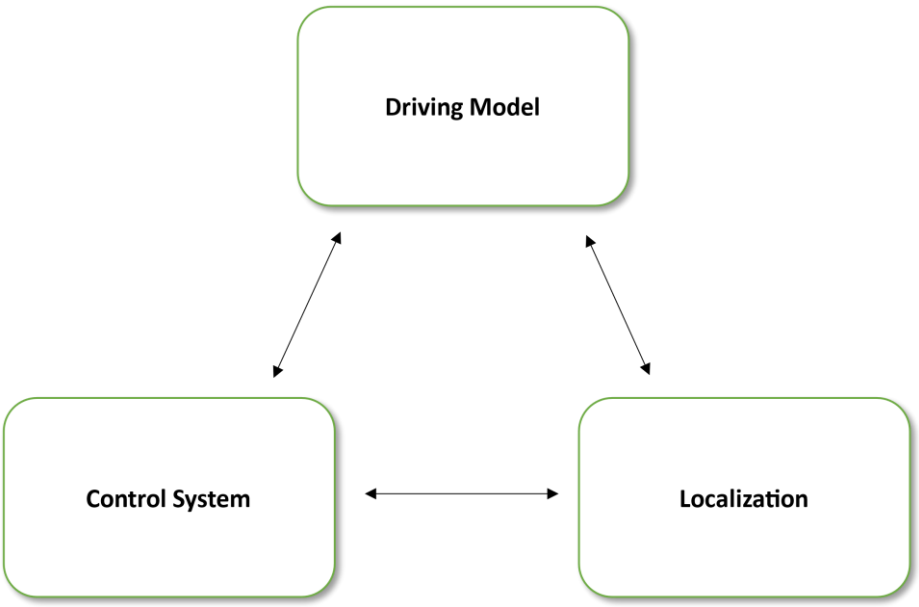

Figure.3.5 Interdependency between Driving Model, Control System and Localization. Source: provided by the Author.

However, although software and videogames localization assuming even more relevance over time, it is today under-researched in both game studies and translation studies (O'Hagan & Chandler, 2016; Pirrone & D'Ulizia, 2023).

This regard, and in particular in reference with racing games, the paper highlights the need for further studies focused on specific applications and integrations of videogame localization, in relationship of several aspects, such as player performances and satisfaction levels. Similar studies could be conducted also considering how both localization and control mapping systems can affect the gameplay style of different kinds of players.

This considered, Mario Kart 8 case study could represent an adequate starting point for further investigations with the purpose to contribute in improving the overall quality of future products, pointing on even more inclusiveness.

5.1.5 Conclusions and future directions

This study analyses the role of localization and accessibility features in racing games. Starting by giving an overview about the born and evolution of the genre, the paper analyzed Mario Kart franchise, selecting Mario Kart 8, the latest episode of the saga at the time of writing, as a reference game for presenting a specific case study.

The analysis showed relevant approaches regarding the implementation of audio- visual and driving aids, which become active components of the overall driving model, which consequently represents a key aspect of gameplay experience.

Another discussed aspect is related to the need to make all kinds of players (included users with disabilities, casual players, and children) potentially competitive in single and multiplayer races. In this regard, Mario Kart 8 also added a balance system to have close competitions in races. This approach could be indicated for arcade racing games, where the simulation level is generally low, considering also the usual presence of weapons and power-ups.

Counter wise, considering the higher overall simulation level in simcade, these kinds of games should not consider approaches that would affect the distance gap between players, as driving abilities assume here a primary role in gameplay.

In fact, Forza Motorsport points on a massive use of accessibility features based on both localization and control system management. These scalable options are designed to offer a calibrated aid for any player interested in this genre, making the game also inclusive for blind users.

All this considered, starting by the selected case study, the study contributed in highlighting newer and specific trends to face future challenges related to inclusiveness, localization and accessibility in the selected videogame genres.

In addition, due to the lack of available quantitative data, this study would suggest further researches aimed at investigating the satisfaction levels and gameplay style of various types of players, with particular reference to users with disabilities.

Finally, considering that current studies in the area of control mapping/customization showed opposite results, future researches should focus in involving players with the purpose to

collect relevant data and feedbacks about the preferred control schemes and peripherals.

5.2 Gender gap and localization bugs in new generation open-world games: the case of Cyberpunk 2077

The study is concerned on the area of video game localization and interactive narrative, tied to specific issues and challenges of new generation open-world role-playing games.

Starting by giving an overview about the reference modern methodologies in the design and development of these products, the research adopts a case study approach identifying Cyberpunk 2077 as reference product to analyze. In particular, the investigation focuses on the ways in which the gender question is approached in video game narrative, and especially in the character customization process.

Moreover, the study observes how the sandbox mechanics implemented in modern open-world video games could lead to specific kinds of bugs that affected texts, and that are known as localization bugs.

In order to give a contribution in facing these issues, other than improving the relationship between localizers and programmers, this research would suggest new paths and IT tools that could be respectively followed and used in localization industry.

5.2.1 Description and methodology

Role-playing video games (RPGs) have become a multifaceted cultural phenomenon with a global reach. Since there is still no clear definition of the generic concept of role-playing, RPGs are associated with an indefinite number of media forms and channels.

In the video game field, RPGs are not just a specific type of entertainment software; in fact, several types of products that seem to belong to other genres, such as racing or fighting games, could be characterized by RPG elements.

In this respect, open-world virtual scenarios characterized by sandbox approaches seem to be particularly appreciated by game developers and software houses interested in RPG structures.

Moreover, considering the central role of the main character in these kinds of games, the overall quality textual and audio elements assume a relevant aspect, as the player tends to identify itself with his virtual alter-ego. This interrelation, combined to a high degree of character customization, leads to both generic and specific issues and challenges about gender questions in the area of videogame localization.

The study is composed of six sections, and it is focused on several aspects of videogame localization related to the management of gender gap in modern RPGs.

In particular, in section 5.2.2 the study analyzes the main common approaches adopted in modern RPGs with an open-world structure; also, in section 5.2.3 Cyberpunk 2077 is presented as a selected reference software on which to identify some critical issues and challenges proper to the work of videogame localizers, which are discussed in sections 5.2.4 and 5.2.5.

In particular, in Section 5.2.4, the paper highlights the deep connection between the gender gap and character customization, discussing how gender is no longer tied to the external aspect of the character, but remains in some way related to texts and voiceovers.

This aspect leads to some relevant considerations about specific problems that may arise when adapting non-linear texts in sandbox-based video games. In fact, Section 5.2.5 describes some scenarios where video game localizers have to deal with bugs during the localization phase and try to fix them.

Furthermore, newer reference technologies and methodologies applicable to the localization of modern open-world RPGs are identified and proposed in section 5.2.6. In particular, the possible implementation of artificial intelligence in videogame localization is discussed, also in relation to the use of accessible programming languages, which could prove helpful to face some open challenges proper to this field.

5.2.2 Modern open-world role-play games: approaches and perspectives

During their history, video games have been able to deeply change their face, adapting and evolving themselves in several shapes to develop even new ways of interacting. Some major

examples of these changes could be related to the transition from 2D graphics to 3D polygonal environments, as well as the growing complexity of the narrative, which becomes even more relevant over time.

In addition, in recent years, another component is attracting the attention of both companies/developers and users. This component is now known as open-world structure.

In order to properly comprehend the meaning of this structure, it could be appropriate to mention the concept of free-roaming, which expresses the possibility for the player to move freely in a virtual space in a non-linear way, and therefore decide in which order to complete his objectives.

Although the origin of the term free-roaming is earlier than the open-world conception, these two expressions are often considered interchangeable. This happens because of the fact that the only video games whose level design allows the free-roaming mechanics, are open-world products.

Rouse and Ogden (2000) identified the need to fully utilize the suggestions of virtual worlds, which follow the principle of non-linearity as a tool that provides interactive meaning, in the development of open world products.

By engulfing ideas and stylistic derivations of all kinds, free roaming has triggered a pervasive and transversal revolution, reaching almost all genres.

Moreover, open-world products are often confused with a real genre, which shows how the implementation of the open-world structure has taken a predominant role in the video game industry.

Since the birth of free-roaming mechanics, the linguistic component has been a primary basis of development in many projects. For example, *Colossal Cave Adventure* (1975) was a text-based adventure that first proposed the idea of free exploration in a video game; the player had to explore a cave and try to discover its secrets and treasures.

This entire concept was taken up by Richard Garriott and used in the development of *Ultima I: The First Age of Darkness* (1981). The video game was directly inspired by the board game *Dungeons & Dragons*. This made Ultima I the first interactive role-playing game to feature a

free-roaming mechanic; in effect, it was possible to move around a map consisting of multiple points of interest.

In the years that followed, more products implemented free-roaming dynamics, leading to the release of the first open-world titles, such as *Elite* (1984), *The Legend of Zelda* (1986), *Super Mario 64* (1996), and *Shenmue* (1999). These products are just a few examples of a phenomenon that quickly expanded and led to the most modern concepts of open-world structure.

This study aims to explore the relationship between level design and linguistic/socio-cultural aspects in modern open-world RPGs characterized by a strong narrative component.

In particular, the paper is concerned with linguistic/cultural adaptation processes, known today as localization, with the aim of identifying new strategies and tools to reduce the existing gap in facing some critical specific issues.

In video game industry, and specifically in the case of open-world RPGs, the professional figures responsible of localization process (known under the name of video game localizers) have to operate in two different directions. On the one hand, they have to deal with peculiar linguistic and socio-semiotic aspects such as non-linear storylines and texts, as well as modern cultural issues such as the gender gap, advertising and censorship. On the other hand, they need to communicate efficiently and work in synergy with programmers to avoid technical problems related to languages, while also being able to understand the game and level design structures.

In older video games the linguistic component was mostly characterized by linear texts, so localization was not too different from the simple translation. The same gameplay structure was based on a simple conception of *fetch quests,* where the player was asked to complete tasks by travelling from a point A to a point B almost in absence of dialogues.

In contrast, some modern titles, such as *Grand Theft Auto V* (2013) and *The Witcher 3* (2016), featured large and complex maps where the gameplay was subject to a variety of variables and situations, including the linguistic aspect.

In these scenarios, video game localizers had to face several new challenges due to the lack of specific useful tools and methodologies aimed at solving the most common related problems.

In this regard, both translation studies and software companies began to develop programs and strategies to help localizers in their tasks. Some of these solutions regarding the use of machine translation, standardized codifying systems, and enhanced features in CAT tools.

Meanwhile, the deep changes in cultural aspects of contemporary societies, combined with a further evolution of technologies in video game industries, leaded to even new conceptions of the open-world structures.

In section 2.1, the study identifies *Cyberpunk 2077* (2020) as reference product responsible of a relevant structural change in the development of present and future open-world RPGs.

5.2.3 Cyberpunk 2077: a turning point in designing open-world RPGs

Cyberpunk 2077 (CD Projekt Red, 2020) is an open-world RPG with a moderate presence of sandbox dynamics, set in a fictional and dystopian future.

The developers' first intention was to immerse the player in a vivid and living world with its own identities and dynamics, defined independently of the player's actions. This dense and intricate network was named *Night City* and had the function of offering several unpredictable choices and narrative crossroads, each leading to consequences of different entities.

Most of these choices were made through dialog choices or moral decisions during missions. In addition, the game offers the player three starting points based on three different environments, each characterized by a specific socio-cultural background on which to build the digital avatar.

The game was concepted to run even on the past generation of consoles (Playstation 4 and Xbox One), but the complexity of the developed 3D environment outperformed the hardware capabilities of these platforms. In particular, the Playstation 4 and Xbox One launch versions

were almost unplayable due to the low frame-rate. This mainly happened due to the high number of variables to calculate and process in a map conceptually different from any other open-world videogame previously released.

In fact, the map present in Cyberpunk 2077 defines the most relevant turning point in the development of open-world products. If older productions (even those with a large environment to explore, such as Grand Theft Auto V), presented a map extended in two dimensions, Cyberpunk 2077 was developed around a cubic fully explorable 3D environment.

Night City was designed with several layers, each one with passable roads and visitable buildings. Figure 1 shows a portion of the game map, where is possible to note the open-world conception in the game.

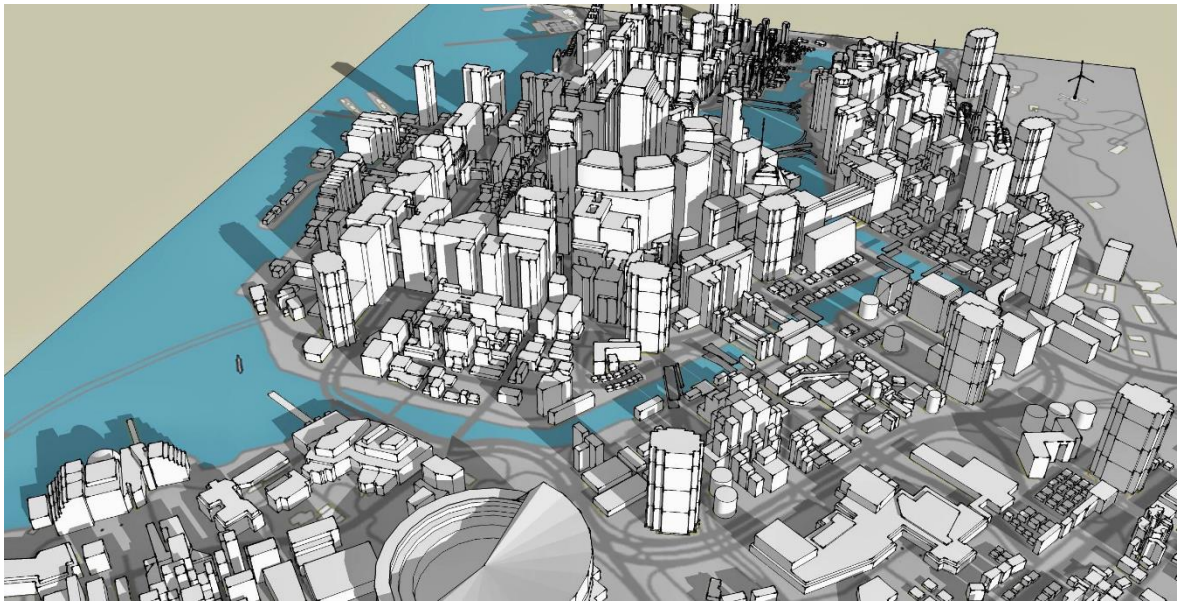

Figure 4.5 Open-world structure in Cyberpunk 2077. Source: https://www.reddit.com/r/cyberpunkgame/comments/12f3c0m/night_city_3d/.

As previously mentioned, Night City was characterized by its own socio-cultural background, where citizens who re-built it with the aid of small corporations after a disastrous event known as “Hot War”, were differentiated for power position and ethnic groups (Batylda, 2020).

Cyberpunk 2077 also presented a new system of character customization, allowing players to choose between a multitude of body trait and parameters that transcend the biological concept of gender. For example, it was possible to build a virtual avatar with both masculine

and feminine traits, with also the presence of cybernetic parts. Figure 5.5 shows an overview of Cyberpunk 2077-character customization menu.

Figure 5.5 Character customization screen in Cyberpunk 2077. Source: https://www.forbes.com/sites/paultassi/2021/02/05/cyberpunk-2077-players-are-trying-to-make-the-perfect-v-sharing-character-creation-presets/.

Although the game was also released for personal computer and converted for modern consoles, such as PlayStation 5 and Xbox Series X/S, Cyberpunk 2077 reports still today a considerable number of bugs and glitches not yet fixed, which are tied to several aspects of the game.

In particular, the most obvious problems relate to character animations, sounds, text, and other elements that partially ruin the gameplay experience. In addition, the textual problems had a certain impact on the work of video game localizers, who had to deal with a product with structural problems in multilingual support.

There were two main reasons for this large number of problems: on the one hand, the development process was based on supporting hardware platforms that were not fully capable, such as old-generation game consoles. On the other hand, the new concept of open-world structure and sandbox mechanics generated a large number of variables and situations that were difficult to check before launch, also due to a fixed release date. Nevertheless,

Cyberpunk 2077 undoubtedly represented a product capable to change the common idea of sandbox-based open-world video games.

Section 5.2.4 discusses several aspects of character customization, with a particular focus on the gender gap, and some of the resulting implications for the work of game localizers.

5.2.4 Gender gap and character customization

Character customization is one of the most important aspects of role-playing games. In fact, the ability to customize a character can affect the player's emotions because of the tendency to identify with a virtual alter ego (Hefner et al., 2007). Customization also contributes to creating and maintaining a deep emotional connection between the player and the character (Turkay & Kinzer, 2014).

Moreover, (Lankoski & Björk, 2007) highlighted many other aspectsIn addition to character customization, this will affect the player's personal experience and character personality, which will influence choices. These aspects involve dialogue options or possible actions leading to social consequences (Bocci, 2019; Perron, 2016).

For video game characters, Kromand (2007) made a classification between open and closed avatars in relation to the degree of customization that describes a digital avatar. For example, game characters with a well-defined and pre-generated personality, such as the popular *Agent 47*, *Lara Croft* or *Kratos*, are classified as closed avatars. All characters that do not have specific personality traits are referred to as open avatars.

This study focuses mainly on open avatars, as they are often the default type of character in open-world RPGs. In addition, the high degree of customization led to the discussion of some relevant issues regarding gender gap and localization challenges.

Lankoski and Björk (2007) also categorized three areas affected by character design and customization:

- Sociology (i.e., hobbies and free time, friends, education and work).
- Psychology (i.e., moral standards, temperament, obsessions/compulsions).
- Physiology (i.e., appearance, weight and height, sex and age).

All these areas point out the complexity level of character creation phase. In this regard, cosmetic customization represents the first relevant factor to consider. Although in most cases the exterior aspect does not have any consequence for in-game mechanics, the way the character looks could reflect some personality traits which are perceived in a certain way by society. In fact, Ducheneaut, Wen, Yee and Wadley (2009), state that, in this way, players can communicate to others the way how they want to be perceived.

Modern RPGs video games allow to change a high number of exterior particles, such as skin colour, the body shape, clothes and accessories, tattoos etc.

Adams & Rollings (2010) observed that digital characters in role-playing games represent a kind of digital mask that players wear in relation to the goals of the game. Moreover, he claims that the sense of freedom experienced in open-world video games, combined with a massive degree of expressiveness through customization, puts players in the position of exercising their own creativity in a spontaneous way.

In this scenario, the question of gender has been discussed over the years. In the early 2000's, Platten (2007) analysed the relationship between players and characters, by observing the tendency of users to impersonate avatar of their same gender, in order to maintain a bond of identity with the character. He also noted that choosing a different gender led to different kinds of bonds between the user and the avatar: for example, some male users who chose female characters in games did not imagine themselves to be Bayonetta or Lara Croft, but expressed a desire to replace a real-life partner with them.

Adams & Rollings (2010) agreed with these statements, by adding that, due to the growing number of female players, even the option to choose a female character has become even more common over time.

These scenarios began to create new problems and challenges for the localization industry. In fact, video game localizers were faced with the need to create two versions of the same textual

content for different languages in order to reflect the correct gender differences in dialogues and narratives.

Mass Effect Saga (2009-2017), *Dragon Age* games (2010-2015), and *Assassin's Creed Odyssey* (2018) are some of the games that allow you to choose between male or female characters. In this context, some specific physical characteristics have been associated with the selected gender, without the possibility to customize them.

In these cases, both aesthetic traits and textual contents contributed to identifying the character's gender in the game.

Nowadays, due to some deep social changes that have occurred over time, the situation is different. The gender question has become more complex, by presenting new elements to considerate and explore in interactive digital narrations. In fact, in modern open-world RPGs the aesthetic factor is no longer bond to sexual gender. As mentioned in section 2.1, in Cyberpunk 2077 it is possible to customize almost all body trait, by choosing also between cybernetic implants and mechanic prothesis. Also, it is possible to associate different vocal timbres to character voices, including robotic ones. In addition, even more modern application software and video games offer to users the possibility to not declare any specific gender.

Consequently, textual contents represent relevant variables bond to gender question in video games. This implies that video game localizers have to deal with a multitude of adaptive texts, that should include several verbal forms, including gender-neutral language.

This study will not examine the gender issue from an ethical point of view, but will focus on the main implications of the gender gap in the localization industry (especially in relation to modern open-word RPGs), with the aim of identifying new ways to achieve more accessible and inclusive products, characterized by better overall quality.

Section 5.2.5 explores some general mechanics of the sandbox structure by focusing on some specific types of bugs that can occur during the localization phase.

5.2.5 Sandbox games and localization bugs

Among all the mechanics implemented in open-world video games, the sandbox structure is said to be the most efficient in terms of giving players a high sense of freedom.

In other words, a sandbox-based video game base his conceptual philosophy on the exploration of virtual scenarios, allowing the highest possible grade of interaction with the items present in a virtual world. In this way, as the entire environment becomes the matter on which to interact, the sandbox structure turns out to be a suitable place for creative approaches from the players.

In sandbox-based open-world games, the narrative path is non-linear, and it is possible to complete game objectives in any order. This object-oriented *dynamic narrative* (Pirrone & D'Ulizia, 2023) allows to use several ways to achieve a goal in the game. This structure appears also indicated for all those game developers who intend to create products with multiple or even not defined endings.

Moreover, the freedom feeling given by sandbox-based titles can generate a massive quote of variables bond to the various situations which can occur during the game. Consequently, designing a sandbox-based open-world requires considerable efforts, due to the potential number of bugs and other software issues. As also mentioned in section 2.1, Some examples of these potential problems could be related to compenetrating polygons, wrong animations, missing textures, and also freezes and crashes.

Nevertheless, some of the possible issues could be tied to the text. Even if these problems seem and could be related to programming errors or bad optimization, they often reveal themselves only when the textual contents have been implemented.

For these reasons, the localization industry includes a further review phase known as localization testing. The *GLOS International Localization School* (https://www.gameslocalizationschool. com/en/videogame-localization-bugs/) has reported and described the most common textual errors that can occur in games:

- **Bugs related to variables**: “In localization processes, sentences are often divided in segments in order to insert some fragments, usually tied to that video game design, in other lines. Sometimes these fragments are correctly translated, but they appear meaningless in the complete sentence”.
- **Lack of context**: “Often, video game localizers do not have a clear context around what they are translating. This can cause some types of errors. For example, one problem is related to characters gender. One female character could refer to herself with male pronouns even if that choice is not tied to that character design. There are character names that can be used for males and females, others are completely neutral and, on top of that, the fantasy names. Clients should send images of each character to avoid this type of confusion. Another problem is tied to the tone of voice. The localizer cannot understand from text alone if they are working on a newspaper article or on a conversation. The translation could be correct but not optimized to the context”.
- **Bugs tied to text length**: “Word length can vary in different languages, both for the character amount or the horizontal space they take up. This can cause some problems if the text is inserted in narrow spaces like menu buttons”.

Although the results of localization testing allow to define the bug’s causes, allowing to programmers to fix them, this study would suggest some praxes that could prevent in part textual issues in videogame localization, with particular reference to modern and future sandbox-based open-world videogames. This could help both game localizers and programmers to complete their tasks easily and faster.

In this respect, a first way to reduce the risk of textual bugs could be to involve localizers in the first development phases. In fact, creating a constant dialogue between programmers and localizers could prevent possible mistakes with space limitations and special textual characters. This could allow to localizers to easily correct text directly in-game, without involving the programmer. It may also be helpful to provide localizers with as much information as possible about the project to avoid mistakes about characters, plot, and context. This information could include text and multimedia content such as images and movies.

Unfortunately, as the professional profiles of software and video game localizers are yet not properly defined, studies show the presence of a gap about the relevant skills that localizers have to possess. Among these skills, localizers have to distinguish text from code, even if this could not be enough to face modern challenges in this field, especially in localization of modern open-world RPGs; in fact, as most localizers do not have familiarity with the use of programming languages, the study would suggest a starting path to use code for localization purposes.

In Section 5.2.6, the study identified Python as one of the most accessible programming languages and suggested how it could be used by localizers to help them perform faster and more efficient linguistic/cultural adaptation of modern video games.

5.2.6 Towards new technologies in localization of open-world videogames

As mentioned before, software and video game localizers have to distinguish between text and code when they translate and adapt digital products. Although possessing programming skills is not required to them, knowing the main dynamics of programming languages could help in the identification of bugs and other kinds of problems that would affect not only the localization phase, but also the software operation. Possessing a certain grade of programming skills would also allow localizers to better communicate with programmers and developers, making possible a more efficient cooperation between them, even during the first stages of software development. Moreover, programming languages could also help to perform localization in a faster way.

Unfortunately, the most common programming languages adopted in video game development, such as *C++, C#, Swift or JavaScript,* are often difficult for beginners to learn, as they need specific prerequisites and advanced knowledge under the area of software engineering and computer science.

In this regard, the study identified *Phyton* as a reference accessible programming language that could be adopted by video game localizers for the double purpose to enhance the localization processes, and to learn the basic dynamics of programming.

On the basis of the work of Prechelt (2000), Table 1.5 roughly compares Phyton to some of other common programming languages, in terms of ease of learning, execution speed, community support, documentation and maintainability.

Table 1.5 Python compared to other programming languages.

	Python	**C++**	**C#**	**JavaScript**
Ease of learning*	+++++	++	+++	+++
Execution speed*	++	+++++	+++	++
Community support*	+++++	+++	++	++++
Documentation*	++++	+++	+++++	++++
Maintainability*	++++	++	+++++	+++

**Reported symbols are meant to give a generic comparison in regarding to specific features.*

Due to his high grade of versatility, Python would give the possibility to be used for both translation and localization purposes. In fact, it could be used for:

- Read and edit the main file types used in assisted translation/localization, such as: *html, docx, csv, txt, zip, tmx, xliff*.
- Write regular expressions to match pattern of texts.
- Create graphical user interfaces (GUI).
- Implement machine translation technologies or other systems based on A.I. (such as *ChatGPT* or *Google Bard*).
- Perform Quality Assurance checks of translated files.

In the specific case of sandbox-based open-world products, adopting Python would help professional profiles of localization industry to improve both speed and quality in the adaptation of nonlinear texts, by assuming a more efficient role in the supervision in translation and localization processes. It would also be possible to fix localization bugs by controlling textual variables.

In particular, Table 2.5 reported some examples about the application of *Python Control Flow Tools* in textual variables, showing also how Python would be close to natural language.

In Figure 6.5 it is possible to observe some example of command lines to import multilingual machine translation engines, such as *Google Translator* or *Deepl*.

Table 2.5 Python Control Flow Tools applied to textual variables.

Statement	**Explanation**	**Example**
if	Run if true	**if** “p” **in** “pear”: print (“p is in pear”)
If-else	Run one of two statements	**If** “p” **in** “pear” print (“p is in pear”) **else**: print (“p is not in pear”)
If-elif-else	Run one of n. statements	**if** "c" **in** "pear": print ("c is in pear") **elif** "d" **in** "pear": print ("d is in pear") **elif** "e" **in** "pear": print ("e is in pear") **else**: print ("d,c, and e are not in pear")
for	Iterate n. times	>>> **for** letter **in** "pear" ... print (letter, end="-") p-e-a-r-

```
from googletrans import Translator
translator= Translator(to_lang="fr")
translation = translator.translate("Good Morning!")
print translation
“Bonjour!”
```

Figure 6.5 Importing machine translation engines in Python. Source: provided by the Author.

These represented just two insights for a multitude of possible applications of Python in translation and localization. In this regard, this study aims to contribute in identifying some new useful and efficient support tools that may be used in localization industry.

Furthermore, Python could also represent a helpful tool in dealing with gender gap and inclusive language in localization. In these scenarios, it is possible to use some pre-compiled scripts meant to automatically search for non-inclusive terms, with the purpose to suggest one or more alternative words. In order to complete the task, these scripts perform a pre-processing of the text, and then exploit a specific lexical-semantic dataset, searching for exclusionary terms. For each exclusionary word found, the algorithm will propose a replacement term to the user. The diagram showed in Figure 7.5 reports in detail the operational way of the script, while in Figure 8.5 it is possible to see an example of how the algorithm works through Python user interface. In this regard, several accessible open-source editable scripts are easily available on the web.

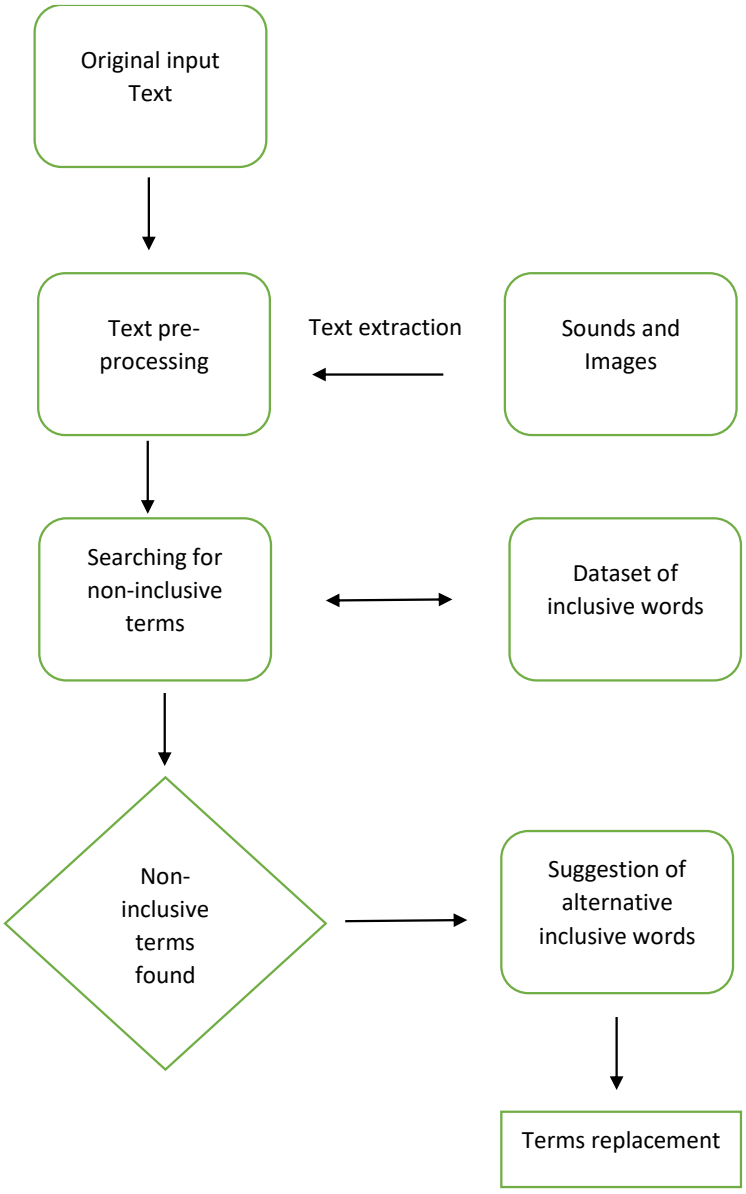

Figure 7.5 Operating diagram of inclusive language scripts. Source: provided by the Author.

Submitted text

Theory of relativity is considered one of the most important discoveries for man

Recommendations

Instead of man consider humanity or humankind

Figure 8.5 Example of inclusive language scripts in Python user interface. Source: provided by the Author.

Although Python was not specifically created for translation and localization purposes, it has proven to be versatile, by offering several advantages to new and existing professional profile in these areas. In conclusion, it could represent a way to create more contact points between linguists and programmers.

5.2.7 Conclusions and future directions

The study investigated some specific aspects of video game localization in relationship with the structure and the narrative component of modern sandbox-based open-world role-playing games.

Starting from the observation of the state of the art about the current approaches adopted in these digital products, this thesis selected Cyberpunk 2077 as a reference product for a case study analysis.

Due to his peculiar mechanics and structures, Cyberpunk 2077 represents a turning point in the design of modern and future open-world RPGs. In particular, the way in which the game is concepted offers a gameplay experience characterized by a high number of variables and situations. Also, the character-building model offers a multitude of customization parameters to choose from, including the simultaneous presence in the same character of masculine and feminine body traits, other than robotic parts. In consequence of this, textual contents remain the only reference items related with the identification of gender.

By analyzing these elements, the study highlighted some issues and open challenges in relationship with video game localization and interactive storytelling. In particular, modern video games could be affected by localization bugs tied to the text appearance.

As both Localization bugs and gender gap questions are today in responsibility of software and video game localizers, the study wanted to contribute in the identification of new paths and tools in support of localization industry. In this regard, this research was focused in a

comparison of commonly used programming languages, with the purpose to select and suggest accessible IT tools to video game localizers.

Although not specifically designed for computer assisted translation and localization, Phyton incorporates specific features and commands that could be used in these fields; in particular, Phyton can manage the main file formats used in computer assisted translation and localization, presenting also the possibility to interact with textual variables and machine translation engines.

Moreover, Python does not require particular pre-requisites to be learned. In fact, there are not required advanced knowledges in computer science or software engineering, also due to its closeness to the natural language.

In this regard, the study showed some insights in relationship with the use of Python features in some localization scenarios, with the purpose to offer a contribution in the development of further researches in this area, aimed to improve the communication between programmers and localizers, through the adoption and use of accessible IT tools.

5.3 Humour and localization approaches in puzzle adventure games: the Monkey Island saga

The study aims to investigate a particular aspect of video game localization related to the linguistic/cultural adaptation of humorous textual elements in point-and-click adventure games, highlighting modern translation strategies and new operational aspects aimed at overcoming some problems and limitations in this area. Beginning with a state-of-the-art report on the birth and evolution of puzzle adventure games and their accessibility features, the research is built around a case study approach based on the Monkey Island video game saga. In particular, the study concerns on transcreation applied to localization of humoristic and idiomatic expressions of this game genre, with particular reference to riddles and puzzle structures. Furthermore, the problem of under-resourced language support is discussed, in the attempt to identify new reliable and affordable localization strategies to be adopted in video game industry.

5.3.1 Description and methodology

The research investigates the fields of video game localization and interactive digital storytelling, by focusing on *puzzle adventure games*.

This genre of digital products, also known as *point-and-click adventures* (since the mouse is the main input peripheral used to play them), is characterized by the presence of humor as a primary aspect of a large number of titles. *LucasArt* productions, such as *Indiana Jones and the fate of Atlantis* (1992) and *Monkey Island* games (1990-2022) represented only few examples of puzzle adventure games where metafictional humor played a high impact role in the storyline structure and in character's development.

This study, divided into 5 sections and based on a case study approach, aims to contribute in the definition of some new paths and strategies that could come in support of localization industry during the linguistic and cultural adaptations of modern puzzle adventure games. Also, the research is focused on the professional profile of video game localizer, by highlighting

some specific competences required to deal with the most common issues and challenges proper of humoristic puzzle games.

Beginning with an overview of the birth and evolution of point-and-click puzzle games in Section 5.3.2, the study analyzes some features related to accessibility and user interface in Section 5.3.3.

In Section 5.3.4, a case study of the Monkey Island saga will be conducted to describe the localization approaches used in the games in relation to the humorous components.

Moreover, some challenges about localization strategies in puzzle games are investigated in Section 5.3.5, with particular reference to other peculiar topics, such the role of marketing strategies in video game localization, that could affect the way in which creativity can be used in textual adaptations.

Another crucial aspect of this research is highlighted in Section 5.3.6 and is related to the linguistic and cultural adaptation of all the textual content that is part of puzzles in video games. In particular, as the puzzle structure is often divided in sections, such as riddles, dialogues, quests and solutions, the study analyzes the main currently adopted semantic approaches to localization, that will focus the attention to some limitations, leading to further open challenges, discussed in Section 5.3.7.

In conclusion, in Section 5.3.8 this research would give a contribute to deal with these challenges by identifying some new paths and operational proposals to better support both software houses and localization industry during the development and release of puzzle adventure games.

In this regard, crowdsourcing is seen as a powerful and affordable resource to better support localization phases, including better implementation of low-resource languages.

5.3.2 Birth and evolution of point and click adventures

The birth and evolution of point-and-click adventure games represent a significant chapter in the history of digital entertainment and interactive storytelling. The genre emerged during the 80s as a response to the limitations of text-based adventure games, aiming to enhance user experience by introducing a graphical interface and intuitive control mechanisms.

Point-and-click adventure games represent a genre of video games that rely on exploration, puzzle-solving, and narrative-driven gameplay. The defining characteristic of these games is the use of a mouse or similar input device for interacting with the game world. Players can navigate through the virtual environment by clicking on various objects, characters, or locations, and these interactions trigger actions or responses within the game. The genre often emphasizes storytelling, character development, and intricate puzzles that players must solve to progress through the game.

One of the representative titles of this genre was *Mystery House* (1980), created by Roberta and Ken Williams, founders of Sierra On-Line Studio. In particular, this game featured rudimentary graphics and a point-and-click interface, allowing players to interact with the game world by clicking on objects rather than typing commands.

Several years later, *Lucasfilm Games' Maniac Mansion* (1987) further contributed to evolve the genre by implementing the *SCUMM* (Script Creation Utility for Maniac Mansion) game engine, refining the user interface and introducing a more complex narrative structure.

In this regard, SCUMM revolutionized the way in which point and click adventure games were both created and played, by facilitating the departure from conventional text-based commands, introducing a visual, point-and-click interface that significantly enhanced player interaction and immersion. SCUMM was also notable for its script-driven design, allowing developers to easily create complex narratives and puzzles.

The apex of the genre's evolution arrived with the release of *The Secret of Monkey Island*, created by Ron Gilbert, Tim Schafer and Dave Grossman, and developed by Lucas Film Games (1990). The game not only presented improved graphics and voice acting, but also established a benchmark for humour and storytelling.

Set in a vibrant and colourful Caribbean-inspired world, The secret of Monkey Island combined humour, memorable characters, and complex puzzles to create an immersive and enjoyable gameplay experience. The game achieved great success, and other sequels came out over time.

As technology advanced, point-and-click adventure games evolved to incorporate more sophisticated graphics, voice acting, and more complex puzzles. Also, the visual aesthetics varied over the years, ranging from pixel art to more sophisticated 3D graphics. Some classic examples of this variety are titles like *Grim Fandango* from *LucasArts* (1998), Broken Sword (*Revolution Software*, 1996), and Deponia (*Daedelic Entertainment*, 2012).

Eventually, although the genre experienced a decline in popularity in the late 1990s, a resurgence occurred in the 2010s with the rise of indie game development, demonstrating the enduring appeal and adaptability of point-and-click adventure games in the ever-changing landscape of digital gaming.

5.3.3 From pixel hunting to accessibility options

Although the continuous alternance of the graphic styles made sometimes puzzle adventure games difficult to recognize between older and newer releases, the level design and gameplay structure of these products have significantly changed their approaches over time.

The most significant change in this regard relates to the way players explore virtual scenarios in search of objects and other items. In fact, in the oldest titles, which typically featured low-resolution graphics, most of the smallest clickable/selectable items were difficult to identify because they could be confused with background. As often players had to carefully search for these bunches of pixels, this action become known as *pixel hunting*.

As newer and more sophisticated games were released, the pixel-hunting phenomenon tended to disappear as both graphics and resolution improved. Also, most developers completely revisited the way in which the objects were searched, by making possible for players to highlight all of them by pressing a button. In this way, all the objects present on the

screen revealed themselves as selectable hot-spots. This new accessibility feature was well received by players, as the pixel-hunting approach could lead to frustration and hinder the overall flow of the game. Figure 9.5 shows the difference between the pixel-hunting and hot-spot approaches.

Figure 9.5 Pixel hunting vs hot-spots. Source: provided by the Author.

The evolution from pixel hunting to the concept of hot spots in point-and-click adventure games represented an important step in game design that significantly enhanced the player experience. The transition to hot spots, where specific areas on the screen are designated as interactive, marked a departure from past approaches. Designers began to implement a more

intuitive and user-friendly system, allowing players to focus their interactions on predefined points of interest. This evolution not only streamlined gameplay but also contributed to a more immersive and enjoyable experience, as players could concentrate on the narrative and puzzles without getting stuck by the limitations of pixel-perfect exploration. The adoption of hot spots exemplified the gameplay experience by enhancing accessibility and engagement in point-and-click adventure games, reflecting a maturation in game design philosophy and a responsiveness to player's feedback.

More newer accessibility features were proper of localization area. The most relevant ones were related to the structure of subtitles. It began possible for players to choose the size, the colours and the speed of texts. These customizations, other than making substantial improvements to the gameplay experience, also helped players with disabilities (such as colour blindness and visual impairments) to enjoy these games.

Eventually, even other accessibility elements were integrated, such as the difficulty selection or hints for puzzles resolution. These hints could appear as textual aids, or as character's thoughts out louds when the player appeared to be stuck.

5.3.4 Humor and localization: the Monkey Island saga

The Monkey Island saga stands as an exemplary legacy of the evolution of narrative-driven video games, demonstrating a paradigm shift in the adventure game genre.

Beginning with The Secret of Monkey Island in 1990, the saga was created by Ron Gilbert and developed by Lucasfilm Games, later known as LucasArts. The video game introduced players to the unconventional world of *Guybrush Threepwood*, an awkward dreamer with the desire of becoming a mighty pirate. In particular, the game underlined a detachment from the previous more conventional point-and-click adventures, especially in relationship to narrative and humoristic components. However, the saga thus represents not only a chronicle of Guybrush's comical adventures, but also a reflection of the dynamic landscape within the gaming industry itself.

In this regard, the subsequent episodes of this saga, such as *Monkey Island 2: LeChuck's Revenge* (1991) and *The Curse of Monkey Island* (1997), embraced evolving technologies, implementing voice acting, enhanced graphics, other than more sophisticated gameplay mechanics. Furthermore, the release of *Tales of Monkey Island* (2009) saw a collaboration between *Telltale Games* and LucasArts, introducing a serialized format and branching narratives. This evolution characterized the adaptability of the series to contemporary gaming trends while preserving its timeless appeal, captivating audiences across decades.

The latest episode of the saga, *Return to Monkey Island* (2022), shows both a reverence for tradition and a commitment to innovation. Designed and developed as a sequel to the Monkey Island saga, the title carefully navigates between nostalgia and modern mechanics and trends, trying to offer both familiar characters and fresh narratives to players.

Built upon the rich lore and sense of humour established by its predecessors, Return to Monkey Island expands the fictional world of the Caribbean with a more depth narrative. In this regard, its parallel narrative structure and puzzle design, have the purpose to develop players' lateral and critical thinking, other than improving their problem-solving skills.

Furthermore, the game developers wanted to dedicate this product to the fans of the original title, reproducing the classical appeal of point-and-click adventure games in an era dominated by more technologically advanced products and genres.

In this sense, Return to Monkey Island is considered by players and critics more than just a game; it represents a journey back to a beloved era of gaming, where laughter and adventure awaited around every corner.

5.3.5 The use of transcreation in point and click adventures

As is known in video game localization, an important aspect is the necessity to correctly transpose narrative contents to a target linguistic/cultural scenario. In this regard, *Transcreation*, a word composed by "translation" and "creation," is a “technique aimed to transpose language nuances from one cultural scenario to another” (Šiaučiūnė & Liubinienė, 2011). It also represents an evolving field within language services, where translation interacts with creative writing to ensure an efficient transposition of marketing and advertising messages across different cultures.

As stated by Pym (2023),” transcreation is not limited to translating texts, but it also aims at recreating the original intent, style and context”. Moreover, this process goes beyond the concept of literal translation, as its main target is to embrace cultural idiosyncrasies, and consumer behaviours. According to Snell-Hornby (2006), “transcreation represents a deep cultural adaptation within localization, where textual messages conceived in one language and culture are completely reimagined for another”. This service is crucial in global marketing, where the main target is not only to communicate, but also to create emotional connections with the target audience, often leading to more effective brand messaging and consumer engagement (Perron, 2016).

The use of transcreation in point-and-click adventure games is needed due to the fact that this genre heavy reliance on narrative depth and varied cultural scenarios, which are often embedded in puzzles and character dialogues. As the genre has evolved over time, both developers and localizers have increasingly recognized the importance of adapting content to maintain its original appeal across the various cultural landscapes.

For example, Federici (2019) claimed that in point-and-click adventure games, localization cannot merely be linguistic; it must consider the semiotic and cultural layers that are intrinsic to the gaming experience. This is particularly evident in games like *Monkey Island*, where humour, which is a core element, relies heavily on cultural references that may not be universally understood. Here, transcreation becomes “a tool not only related to linguistic

accuracy, but also meant to culturally adapting humour and idioms that are essential to the game's atmosphere and player engagement" (Fernández Costales, 2011).

Additionally, Pedersen (2014) discussed the role of transcreation professional profiles as cultural mediators who must navigate not only language but also the intricate web of cultural symbols and social norms to preserve the game's original feel and playability. In their view, a successful transcreation in point-and-click adventures does not merely translate the game but reimagines it, ensuring that all elements (from scripts to visual cues) cohesively reflect the intended user experience in different cultural contexts.

These insights underline the complexity of transcreation in the video game industry, especially within genres that are as story-driven and culturally embedded as point-and-click adventures. In other words, the detailed attention to linguistic and cultural details is not merely additive, but is essential to maintaining the integrity and appeal of the game across borders.

5.3.6 Puzzles, riddles and localization in Monkey Island saga

The *Monkey Island* saga, well known for its hilarious dialogues and clever puzzles, provides a fascinating case study for the application of transcreation in video games, particularly in how puzzles and riddles are adapted for different cultural audiences. The saga's heavy reliance on wordplays and cultural references sets peculiar challenges and opportunities for transcreation, as discussed in several academic studies.

A significant example of transcreation in the *Monkey Island* series can be found in the famous *Insult Sword Fighting* puzzle featured in *The Secret of Monkey Island*. As detailed by Chandler (2012), the original English phrases such as "You fight like a dairy farmer!" and its retort "How appropriate. You fight like a cow!" rely on cultural knowledge of English idioms and humour, which might not directly translate into other languages. The German version of this puzzle, for example, adapts the insult to "Du kämpfst wie ein dummer Bauer" ("You fight like a dairy farmer"), and the retort to "Passend, du kämpfst wie eine Kuh" ("Appropriate, you fight like a

cow"), which retains the structural humour while adapting the content to be more accessible to German speakers (see Figure 10.5).

Figure 10.5 The Secret of Monkey Island – Insult Sword Fighting. Source: https://tvtropes.org/pmwiki/pmwiki.php/Main/YouFightLikeACow.

This example identifies the transcreation role not just as translation, but as cultural interpretation and creative writing, ensuring that the game mechanics linked to the original language are still functional and enjoyable in the target language.

In another instance, the riddle involving "grog" in *Monkey Island* required careful consideration. As noted by Rahman (2003), grog, a historically significant drink for pirates, assumed different connotations and historical relevance across cultures. The transcreation team had to ensure that references to grog maintained their humorous and thematic relevance without making players unfamiliar with the historical or cultural significance of the beverage in pirate lore.

These examples illustrate the high effort required in transcreation to maintain the game's original humour, cultural references, and, crucially, the mechanics of gameplay across different languages and cultures. As O'Hagan and Mangiron (2013) claimed, transcreation in adventure games like *Monkey Island* goes beyond the concept of translation, by adapting the product to meet cultural contexts and player expectations, also maintaining the figurative language of the genre, so that the experience remains authentic and enjoyable for all audiences. This careful balancing act ensures that the humour, playability, and immersive

experience of the game are not lost in translation but rather enhanced for the great variety of players around the world.

5.3.7 Limitations and challenges in localization of point and click adventures

The localization of point-and-click adventure games presents a series of significant challenges that stem largely from their narrative complexity and cultural specificity. A first limitation is the dense integration of language with gameplay mechanics, such as puzzles and riddles that rely heavily on linguistic features like idioms, puns, and wordplay. O'Hagan and Mangiron (2013) stated that the localization of video games does not represent a merely linguistic exercise, but also a cultural one. In this regard, players must understand the main cultural references to properly navigate the game. This intertwining of language and gameplay mechanics often necessitates not just translation but a high level of transcreation, as it is possible to observe in *Monkey Island*, where humour and puzzles are deeply related with English-speaking cultures (Mangiron, O'Hagan, 2006).

Furthermore, Chandler (2012) highlights the visual and auditory elements of point-and-click games that often accompany textual elements, which must also be localized to preserve the game's atmosphere and emotional impact. This includes the adaptation of graphics, animations, and sound effects that might convey culturally specific meanings. For example, visual puns or culturally specific symbols may need alteration to be understandable or appropriate in different cultural contexts.

Technical constraints also pose a significant challenge in the localization process. As Bernal-Merino (2015) stated, the rigid structure of game code can limit the way in which text and dialogue can be altered without causing bugs or disrupting gameplay mechanics. This technical limitation often forces localizers to look for creative solutions that fit within the existing game architecture.

In conclusion, the localization of point-and-click adventure games involves complex layers of linguistic, cultural, audiovisual and technical adaptation. Each of these elements must be meticulously managed to ensure that the game remains playable, engaging, and culturally

relevant to all kinds of audiences across the globe. These challenges underscore the multidimensional skill set required in game localization, which goes far beyond the simple translation and enters the field of cultural consultancy and creative writing.

5.3.8 Crowdsourcing and low-resourced language support

The integration of crowdsourcing as a method for supporting low-resourced languages in the localization of puzzle adventure games represents a significant shift in how game developers approach multilingual support. This strategy relies on the power of the community to translate and adapt content, incentivizing inclusivity and accessibility in languages that normally receive less commercial attention.

Crowdsourcing has been acclaimed for its potential to “democratize” the localization process by involving native speakers and enthusiasts directly in the localization efforts. As highlighted by O’Hagan (2011), the collaborative basis of crowdsourcing can greatly enhance the quality and cultural relevance of translations; this is true for all those languages that professional localizers might not fully understand in terms of regional dialects and other cultural aspects. This approach not only helps in maintaining the narrative charm and gameplay mechanics crucial in puzzle adventure games, but also ensures cultural aspects are appropriately conveyed.

Furthermore, Rahman & Gao (2019) emphasize the cost-effectiveness of crowdsourcing, which can be particularly appealing for developers working on indie games or games with limited budgets. By utilizing crowdsourcing platforms, developers can extend their linguistic reach without the expensive financial loads typically associated with professional localization services. This method allows to add the support of more languages, potentially increasing the game's capabilities of being sold. In an opposite way, McDonough & Egbert (2014) questioned the level of the professional skills possessed by people involved in crowdsourcing.

However, relying on crowdsourcing also presents challenges for game developers and localizers, which are mainly related to quality control and consistency. As Mangiron and O’Hagan (2006) discussed, a variable level in the skill level of contributors can lead to

inconsistent quality in translation; in fact, this might affect the whole gameplay experience and also the product's coherence. Also, ensuring consistency and accuracy often requires additional tasks in both editing and review processes, which can diminish some of the cost advantages.

To mitigate these risks, some developers use a sort of hybrid approach, combining crowdsourcing with professional oversight. As described by Bernal-Merino (2015), "implementing a hybrid model where community translations are subsequently reviewed and refined by professional localizers can balance cost efficiency with high-quality standards". This model ensures that the final product maintains linguistic accuracy and cultural appropriateness while still benefiting from the deep cultural insights that community generated content can offer.

In conclusion, crowdsourcing undoubtedly represents a valuable resource for supporting low-resourced languages in the development of localization. It not only facilitates linguistic diversity and broadens access but also engages a global community, enriching the gaming experience. However, to fully leverage its benefits while maintaining quality, careful management and integration of professional oversight are essential.

5.3.9 Conclusions and future studies

This research was focused on the discussion of localization processes in point and click adventures games. The analysis adopted a case study approach, based on the analysis of Monkey Island Saga.

Firstly, the evolution of this game genre was analysed, stating that many changesets have occurred over time, especially in the accessibility field. In fact, in modern productions, are presents a multitude of accessibility features related to localization process, such as the presence of hot spots, audiovisual aids and various types of customizations that affects subtitles colours, size and speed.

Another aspect highlighted is about the use of transcreation (Lepre, 2015) in these kinds of games, where is fundamental to maintain unchanged a certain grade of humour in all target languages. In the attempt to achieve this goal, localizers also have to deal with marketing rules and praxis, other than with cultural aspects proper of a great variety of idiomatic expressions and cultures. In this regard, the study identified some open challenges related with multilanguage support in puzzle adventure games, other than in video games in general. Among the possible strategies to improve multilingual support, crowdsourcing has been selected as one of the most promising.

Crowdsourcing has emerged as a transformative approach in the localization approach of puzzle adventure games, especially for low-resourced languages that are often overlooked by mainstream localization efforts. This method involves the collective knowledge and skills of a global community to translate and culturally adapt game content, thereby extending support to broader linguistic horizons. This can be relevant especially for indie developers or projects with limited budgets, as crowdsourcing presents a cost-effective alternative to professional localization services.

Moreover, crowdsourcing enables developers to access linguistic and cultural expertise from native speakers who are often players themselves, ensuring a more authentic gaming experience.

However, its success largely depends on implementing effective quality control measures and possibly integrating professional localization practices to ensure a high-quality final product.

In this regard, future researches could focus on new ways to use crowdsourcing in the attempt to reduce localization costs, but maintaining a high overall quality level of adaptations. In particular, future studies could explore new possibilities that would involve the integration of crowdsourcing with machine translation technologies or other professional tools capable to offer a proper support to people involved in crowdsourcing.

Discussion

The case studies reported in this section were focused in discussing in detail the operational ways adopted by localization teams in facing and managing a large variety of technical, linguistic, and cultural challenges. Each case study also proposed examples, tools and suggestions of how localization practices can be improved through the adoption of innovative technologies and creative strategies properly designed to maintain the core of the original content while ensuring that it would be suitable for new audiences. These case studies also emphasized the importance of transmedia and nonlinear storytelling, in the attempt to offer a contribution in setting the path for new methodologies and operational scenarios.

Also, this section was also focused on broader issues related to accessibility and inclusivity in localization. In this direction, results showed how localization is now becoming an important element of gameplay mechanics, especially through audiovisual aids included in hybrid and dynamic user interfaces, or dedicated in-game narrative systems aimed to help users with visual impairments.

The gender gap in games was discussed, starting by discussing the way how the gender is representation in these kinds of digital products. As sexual identity is today less tied to the exterior aspect or to the voiceprint of digital characters, it would entirely depend from audiovisual textual content. In consequence of this, localization professionals assumed a responsibility role, also in relationship with existing and new social norms. This considered, as localization industry would require innovative ethical localization methodologies aimed at promoting inclusivity and diversities, this research proposed specific technical tools aimed to help localizers with the management of inclusive lexicon and localization bugs. These tools, characterized by an open-source nature, would be based on the integration between high-level programming languages (i.e. Python), machine translation engines and inclusive lexicon databases. Their main purpose would be to automatically identifying non-inclusive terms and other technical issues related to the language, suggesting possible replacements and solutions.

The study also highlighted the concept of transcreation in relationship with localization of humoristic and idiomatic expressions in video games, with particular reference to riddles and puzzle structures. Furthermore, the problem of under-resourced language support has been discussed, in the attempt to propose new reliable and affordable localization strategies based on crowdsourcing.

Although the games analyzed belong to three different genres with different gameplay mechanics, each product allowed the identification of relevant open challenges and insights for future directions regarding the application of innovative techniques and approaches in game localization, regardless of game genre. In this direction, future digital games could benefit from audiovisual aids and dynamic user interfaces specifically designed to provide a better gaming experience for all types of players, including those with disabilities such as visual and hearing impairments.

In this regard, in Mario Kart 8 it was possible to observe some rudiments of these accessibility features which open the path to newer and more efficient solutions, such as screen narration systems and other improved features to better assist even more players with disabilities, including people who live with color blindness or motion coordination impairments.

Moreover, AI-driven tools and the modern capabilities of high-level programming languages could contribute to overcome gender issues in games, offering systems capable of offering automatic support in identifying non-inclusive terms during the first localization phases. Also, these tools can help localizers in dealing with screen character's limitations and localization bugs, with the aim to prevent a large variety of issues, such as those observed in Cyberpunk 2077.

In conclusion, the analysis of modern point and click adventure games, such as Return to Monkey Island, highlighted some open challenges under the area of multilanguage support, especially in relationship with under-resourced languages. In this regard, new perspectives about the involvement of human resources in localization were identified. For example, the use of crowdsourcing is becoming a valuable and affordable solution in localization industry. Nevertheless, human resources hired through crowdsourcing should be properly supported by companies, which should give them access to the reference technical tools, providing also more information about the projects in which they are involved. In this way, the variable competence levels possessed by these professionals could be leveled in according with the companies' standard requirements.

All the discussed insights could be applied in all game genres and future studies, in the attempt to obtain even more accessible and inclusive products.

Chapter 6. New hybrid professional profiles in localization industry, among new skills and educational pathways

Introduction

This chapter represents the final part of the whole study. This conclusive section, starting by the interpretation of the case studies results, will be focused on defining new skills, competences and operational directions for both new and existing professional profiles in localization industry. In the attempt to do this, the chapter will be divided into two subsections, each providing a comprehensive overview of the evolving localization industry needs and corresponding educational responses within the field of video game localization.

In Section 6.1, titled *New Professional Profiles in Localization Industry*, will be explored the rapid evolution and the increasing complexity of localization processes, that now require more specialized skills and new operational roles. As the IT tools designed for translation and localization continue to expand, so does the need for professionals who not only are able to understand traditional localization techniques and tasks, but can also contribute in the innovation and adaptation of new instruments, strategies and methodologies. Some of these pathways start from the birth of nonlinear digital storytelling and *SEO localization*, which would require a proper understanding of both narrative and algorithmic optimizations, to the definition of hybrid professionals, such as the *Localization Engineer*, which would act as bridger profile between localizers and programmers. In this regard, it will be explored the ways in which these new profiles can bridge gaps enhancing communication between programmers and localizers. Also, will be reported an interview to Nicholas Lambson, a localization engineer working on automation and machine translation fields, aimed to discuss about the critical operational skills and advanced communication abilities needed to manage and effectively execute complex localization tasks.

After exploring these new roles, Section 6.2, named *Teaching methods and new educational pathways in video game Localization*, changes the focus to the educational framework, aimed at preparing next professionals in the field. This section uses video games as the main topic and discusses specific areas that meet various specific needs of

this sector. Will be also examined various learning strategies used in video game localization courses, exploring the profile of *Game localization teacher*, and discussing the techniques and strategies needed to teach localization enthusiasts. This section also examines the current education system scenario in Europe, evaluating the possibilities for educational opportunities across the countries, considering also the creation of international graduate programs.

An interview with the CEOs of *Maneki Commando* (a video game localization team) is reported with the purpose of strengthened a proper understanding of the effectiveness of building and growing new localization teams. Examining leaders focused on supporting these roles, this chapter aims to provide readers with an understanding of current trends and future directions in the field. This information is aimed at anyone joining or entering in the software and video game localization industry, as it reflects the changing needs in the field.

6.1 New professional profiles in localization industry

The localization industry is now on a significant transformation period, expressing the need for new, modern and hybrid professional profiles capable to bridge existing gaps in localization industry, satisfying the evolving demands of global communication and technological novelties. These kinds of profiles are identified within a shift towards new skills and expertise. Among these profiles, there are *Search Engine Optimization (SEO) localizers*, who are integrating linguistic skills with digital marketing strategies, and *Localization Engineers*, who converge technical expertise with linguistic skills to manage peculiar localization processes and tasks.

Furthermore, the role of these “bridger” professionals has become critical; in fact, these individuals must be capable to improve communication between both developers and localizers to ensure culturally and technically coherent interactive digital products. The presence of these roles in localization industry not only helps in the management of the expanding complexity of projects, but also enhances the strategic role of localization techniques into the broader range of global digital product development. This evolution

process led to a change of direction in the industry, highlighting the need for specific skill sets that go beyond the traditional linguistic abilities.

In this section will be explored the operational role of hybrid localization professionals within their operational scenarios, which are constantly evolving and changing, identifying some crucial technical, managerial, and strategic competencies.

6.1.1 The fast-paced evolution in localization industry

The localization industry, such as all technological realities, constantly experiences rapid transformations, which are mainly driven by technological advancements, other than the primary need for global communication. This fast-paced evolution is characterized by several crucial aspects and tools, including in particular the integration of AI and machine learning (ML) technologies, which have deeply changed the conventional localization workflows. These technologies made easier and more efficient all the tasks related to the process of large volumes of audiovisual content across different languages and platforms, while maintaining or improving the overall quality of translated texts.

In addition, the industry has identified a shift toward more intelligent localization practices, designed to align with the iterative development processes that are prevalent in software and digital content creation. (Jiménez-Crespo, 2024). These peculiar methodologies enable localization teams to work in synergy with development teams, with the advantage of reducing the time dedicated to the various tasks, enhancing also the overall quality of localized digital products in different markets. Furthermore, as modern localization processes are even more centred on user experience due to the increasing audience of users and players, the importance of their feedback has led to a mor meticulous localization testing in specific accessibility elements, such as user interfaces or various audiovisual features. These modern trends are defining a dynamic industry that constantly adapts itself in relationship with technological advancement and the increasing complexity of global market demands.

6.1.2 SEO localization

The Search Engine Optimization (SEO) localization is one of the new areas in this field, and is emerging due to a specific need of digital content globalization, representing a synthesis of search engine optimization techniques with traditional localization practices. This specialization is necessary to ensure that translated web-based applications are not only linguistically accurate, but also optimized for search engine rankings in target markets. (Singh & Pereira, 2005). SEO localization also involves adapting keywords to the context of the culture and search behaviour of the local target audience, with the goal of going beyond standard translation to make them visible in the accuracy and originality of the content in different contexts and cultures. (Jiménez-Crespo, 2024). For example, keyword research in SEO localization must understand regional differences in words and sentences that can affect research and user interaction. This approach also extends to improving meta tags, descriptions, and even structural and visual elements of applications, with the purpose to offer better user experiences and search engine indexing.

Thus, the strategic integration SEO localization not only enhances the efficacy of global digital marketing initiatives but also guarantees that regional content is more aligned with the target audience, thereby boosting engagement and conversion rates.

In addition, integrating copywriting and marketing strategies into SEO localization also has a high impact on customers and participation in international markets. In this direction, copywriting is the foundation for creating engaging content and leads that are optimized for search engines while being relevant to local audiences. By adjusting the message to reflect the language, interests, and culture of the selected region, marketing professionals can present the product's benefits and deeply engage the target audience.

Moreover, SEO marketing strategies in the region not only increase the digital presence of customers, but also increase their involvement in global markets. By strategically planning and delivering content in the target market areas, companies can gain a competitive advantage by positioning themselves as an authority or leader in specific areas, while at the same time transcending language and cultural boundaries.

In addition, the implementation of tags and geo-targeting techniques helps search engines select and deliver the most relevant content to end users based on their location and preferred languages.

SEO localization is also related to *culturally sensitive content creation,* which represents a further crucial aspect in this field, as it involves the actions of adapting messaging, symbolism, imagery, and other items related with local audiences in the respect of the reference cultural sensitivities and norms.

Finally, getting local backlinks from trusted sources can help increase the credibility of websites and web applications in local search engines. By combining these and other local SEO strategies, businesses can reach and engage a variety of global markets and properly drive organic traffic (Honomichi, 2002; Singh & Pereira, 2005).

6.1.3 New approaches in localization project management

Within the fast-paced evolution field of localization, new innovative approaches and methodologies in project management have emerged in response to the needs of global business, technological advancements, and variable user preferences. A first relevant trend in these directions is related to the integration of agile methodologies into project management tasks. These methodologies, initially concepted for software and video game development, incentivize flexibility, teamwork, and iterative development tasks.

Once applied in the area of localization, agile methodologies can provide a more efficient project management, by breaking down large localization projects into smaller and more affordable tasks. This approach can make localization teams more propense to quickly adapt themselves to changing requirements, by dealing with new issues as they show up, delivering also localized content more rapidly.

Another innovative approach is related with the use of neural networks and artificial intelligence in localization project management. These automation technologies and methodologies interact with repetitive tasks such as file processing, translation memories

management and quality assurance checks, in the attempt to reduce manual operations, making project timelines shorter.

AI-based software and tools, such as machine translation technologies and natural language processing algorithms, can improve translation accuracy, quality and consistency, enabling also more sophisticated linguistic analysis and content adaptation for specific markets. By exploiting the power of automation and AI technologies, localization project managers would be able to achieve higher levels of efficiency, scalability, and cost-effectiveness while maintaining the quality of localized content.

In addition, the utilization of cloud-based localization tools has transformed project management workflows by providing a centralized access to project management creating new collaboration tools, which allow to monitor localization projects in real-time. These Cloud-based tools facilitate also the communication and collaboration among the various localization teams involved in a project, other than clients, external vendors and other figures, enabling a smoother project coordination with faster decision-making processes.

Moreover, cloud-based technologies and tools can offer advanced analytics and reporting functionalities, offering to localization project managers the possibility to track progress, to monitor crucial performance indicators, identifying the areas for optimization in real-time.

The increasing demand for localized content related to individual preferences and specific markets has led to the birth of crowd-based localization models. These models generally involve a global network of freelance translators, reviewers, and other expert profiles, in the attempt to localize audiovisual content while maintaining both linguistic and cultural authenticity. The contribution of various linguistic resources and expertise in crowd-based localization models, allow localization project managers to manage large volumes of textual content across multiple languages and markets more efficiently, also meeting the growing demand for customized and culturally relevant content in a cost-effective manner (Rahman & Gao, 2019). Nevertheless, McDonough & Herbert (2014) questioned the professional level of people involved in crowdsourcing.

In conclusion, these innovative approaches in localization project management, including also the adoption of agile methodologies, are redefining the way in which localization

projects are designed, executed, and delivered. In this way, localization teams can respond more effectively to the various and dynamic needs of global markets, achieving higher levels of efficiency, delivering also better-quality localized content welcomed by target audiences worldwide.

6.1.4 Operational skills and communication abilities in localization tasks

Operational and communication skills play an important role in the successful completion of localization tasks, especially in the context of global business operations and cross-cultural communication.

In this context, localization operational skills comprehend a wide range of technical proficiencies necessary for managing and executing localization projects effectively. The needed skills may include proficiency in localization tools and technologies, such as Computer-Assisted Translation (CAT) tools, Translation Management Systems (TMS), and Content Management Systems (CMS).

A proper management of these tools allows localization professionals to better define workflow processes, managing translation memory and glossary databases more efficiently, ensuring high degrees of consistency and accuracy in localized products.

In addition, operational skills extend to linguistic competencies, including proficiency in multiple languages, an understanding of linguistic conventions and writing styles, and an in-depth knowledge of cultural scenarios and sensitivities (Budin, 2006). Localization tasks often involve translating textual content into multiple target languages while ensuring that the tone, style, and cultural references are suitable for any target audience. In this regard, linguistic expertise is needed for producing a high overall quality of translations (Díaz-Millón, 2017).

In addition to operational skills, successful audiovisual localization requires effective communication skills. A clear and effective communication is considered essential for establishing all communicative requirements in localization projects, including conveying expectations, addressing concerns, and resolving other related issues (Díaz-Millón, 2017).

Strong interpersonal skills, active listening, and cultural sensitivity are considered crucial for enhancing collaboration and building bonds with stakeholders from different cultural and linguistic backgrounds.

Moreover, effective communication extends beyond internal localization teams, to include also external audiences, such as customers and final users. Localization professional profiles must communicate by using empathy and clarity to ensure that localized content meet target audiences with their peculiar needs and preferences. This may include conducting specific market research to gather customer feedback in order to refine and customize localized audiovisual content based on user input to improve overall experience and satisfaction.

In summary, operational skills and communication skills can be considered essential competencies for successful localization tasks. Thus, having mastery of localization tools and technologies, joined with linguistic proficiency, and effective communication skills would represent an added value for both localization professionals and localization industry. By promoting the acquisition of these operational skills, organizations would be able to effectively navigate the complexities of several business operations, expanding their reach into new markets audiences and cultural scenarios.

6.1.5 New bridger profiles between programmers and localizers

Considered the high number of transversal skills and competences required by software companies and localization industry, even new professional figures are trying to emerge across the market, in the attempt to fill some existing gaps.

This research is concerned about hybrid profiles trying to merge the skills of programmers with those of software and video game localizers, which represent a unique and increasingly valuable combination in the localization industry. These professionals would be able to operate not only with coding and other software development aspects, but also to deal with the general process of localization. This dual expertise is crucial as the global

market for software and video games expands, necessitating products that are both technically robust and culturally relevant. Studies have shown that localized content significantly enhances user experience and engagement, as users usually prefer software and games that are linguistically and culturally adapted to their needs (Esselink, 2000).

In addition, integrating localization skills into the development process can improve production and reduce the time and cost associated with post-development localization efforts. According to O'Hagan and Mangiron (2013), video game localization in particular is a complex task that goes beyond mere translation and requires a deep understanding of the game's narrative, mechanics, and user interface. Programmers with localization skills can more effectively address these challenges, ensuring that technical and cultural adaptations are seamlessly integrated. This hybrid profile is also beneficial in dynamic development environments where continuous integration and rapid iterations require an effective collaboration between both developers and localizers. (Díaz-Millón, 2017). In conclusion, hybrid professionals should be able to bridge the gap between development and localization, offering a more efficient workflow that enhances the overall quality and accessibility of software and video games in target markets and cultural scenarios.

6.1.6 The Localization Engineer: an attempt to build-up hybrid professional profiles

As previously reported, the scientific gap between programmers and localizers represents a significant open challenge when talking about the development and the distribution of digital applications. While programmers are primarily focused on writing code, optimizing performance, and ensuring functionality across different platforms, localizers would focus in adapting software to meet the cultural and linguistic needs of a specific target market, focusing on translation, localization and transcreation for cultural varieties, making also user interface modifications. This gap divides specific priorities and expertise: if programmers may lack the linguistic and cultural insights needed for effective localization of products, localizers may not fully understand the technical constraints and other structural elements in software development.

Bridging this gap requires interdisciplinary collaboration and enhanced communication. In this regard, Esselink (2002) provided a first definition of a process known as *Localization Engineering,* which is described as the process of designing and implementing a workflow for exporting, translating, and reintegrating content and metadata across a variety of platforms, such as websites, e-learning modules, video games, or software application.

In order to achieve the main goals required from this process, a polyhedric professional with an interdisciplinary academic background is required. Although these professionals are already known in localization industry as *Localization Engineers*, the profile background is not well defined or standardized. One of the main purposes of this research is to establish some relevant criteria for building-up a list of skills and competences useful to standardize this profession. Also, another objective is to propose specific academic pathways for localization engineers, as at the time of this study there are not academic courses designed in this direction.

To better support the study, an interview has been performed involving Nicholas Lambson, which is one of the firsts professionals operating in the field of localization engineering. The interview offered a valuable contribution in the definition of both skills and academic courses meant for localization engineers and other related professional profiles. The integral interview can be found in Appendix C.

In order to properly manage a localization project, providing also an efficient level of communication and coordination within a teamwork, localization engineers should possess a specific list of both soft and hard skills. In this regard, the study would propose some of them in Table 6.1:

Table 6.1 Soft and Hard Skills for Localization Engineers.

Soft Skills	Hard Skills
Team coordination and communication	Understanding content types
Handling and presenting data	Advanced Business Application management
Writing process documentation	Publishing software management
Tracking progress	High-level programming and scripting languages (Phython, HTML, Javascript)
Troubleshooting and QA Check	Game Development platforms (Unity, Click Team Fusion
Taking responsibility of mistakes	Subtitling Software management
Clarifying linguistic issues to both developers and clients	Use of CAT Tools and specific localization software (for example MemoQ and Passolo)

The left column of the table reports a series of relational and communicative skills that can be useful for localization engineers during the management of a localization project. In particular, a first important skill would be the capability to properly use communication strategies to coordinate one or more working groups, also in the attempt to solve potential issues or misunderstandings. Also, localization engineers have to create and handle a

process documentation that should be kept up to date with the latest progresses. In this regard, all the relevant project data should be presented and shared efficiently.

Eventually, other important abilities are related to the phase of Quality Assurance Check, where localization engineers have to be very responsive and efficient in troubleshooting, also taking their own responsibilities for any mistakes. Underlining and clarifying issues can be also useful during the communication between localization engineers and programmers or clients. In fact, localization professionals should be able to clearly describe them any potential problematic scenario, in order to make possible the design of appropriate strategies and methodologies in multilanguage support.

This said, the table's right column shows a list of some valuable technical skills that would be required in this field. Among these, the capability to identify and recognize a large variety of content types and file formats is considered relevant, even in relationship with a proper management of Advanced Business Applications, such as word processors, spreadsheets and database management systems (DBMS). In software and video games localization these kinds of applications (other than the specific ones such as MemoQ or Passolo) are largely used, so being a super user of these software, included also publishing applications, would be considered a strong advantage.

Moreover, localization engineers have to be familiar with several kinds of programming languages mechanics. In particular, this research suggests to learn the main mechanics of high-level programming and scripting languages, such as *Python*, *Javascript* or *HTML*, as their syntax rules are similar to those of natural language. In consequence of this, these kinds of languages are considered accessible and relatively easy to learn. Knowing their functioning allows localization engineers to better understand the work of programmers, and this would make easier to recognize optimization issues that could affect localization and multilanguage support.

In video game area, localization engineer should also familiarize with the main game development platforms, such as Unity or Click Team Fusion, as they are very largely used today.

All this said, it can be easily deductible how localization engineer professional profile would be a hybrid and multifaceted figure. However, although it may seem that localization

engineers have to face too high workloads and responsibilities, in reality these figures should be constantly supported by a multicultural team composed by experts in various fields, such as marketing and legal areas among all. In this way, the profile of localization engineer should give a valuable contribution in reducing both communicative and operational gaps between programmers and linguists in software and videogame development.

6.1.7 Bridger professionals in software and video game localization: some possible pre-requisites.

As mentioned above, training and working as a software localizer or localization engineer typically requires some technical and linguistic skills, but they also need to be supported by a relevant educational background. In this regard, some reference prerequisites could comprehend in one hand degrees in computer science or software engineering, as they provide foundational knowledge in programming languages, software development, and systems engineering. In addition, degrees in linguistics, translation studies, or applied languages can also be valuable, as they provide staff with a deep understanding of language structures, cultural differences, and translation methodologies.

Also, proficiency skills in multiple languages can be also required, and possessing practical experience in software development, especially in collaborative projects, certainly enhances the ability to adapt and optimize software for different linguistic and cultural scenarios. Nevertheless, as previously reported, some soft skills such as problem-solving, attention to detail, and effective communication are critical, as they enable localization professionals to properly achieve complex localization goals, working collaboratively with various teamwork.

These topics will be further discussed in the second part of this chapter, as it will be focused in educational pathways for localization professionals.

6.2 Teaching methods and new educational pathways in software and video game Localization.

This section of the study will be dedicated to investigate the educational background of localization professionals. In particular, the final purpose of this work will be some proposals of new academic courses designed to train localizers and new bridger professionals. In fact, the dynamic field of localization industry necessitates innovative teaching methods and courses to equip students with all the skills and knowledge requested by industry.

An effective education in this field should mix practical and theoretical approaches, facing the peculiar challenges of localizing interactive media.

A central aspect of this section will be the definition of video game localization teacher, meant as a professional capable to reduce the gap between academia and industry. To do this, teachers should be hybrid profiles combining expertise in translation studies, game studies, and technical skills related to software localization. Game localization teachers should also possess practical industry experience to put the students in contact with current trends and professional techniques.

Moreover, pedagogical strategies aimed for video game localization classes will be discussed, by focusing on the integration between both hands-on training and theoretical knowledge, in the attempt to create a comprehensive learning environment. In this regard, both practical tasks and exercises involving localization tools can simulate real-world localization contexts and situations. Thus, teaching modules must also cover technical aspects, such as coding and software handling, and stylistic strategies, including cultural adaptation to maintain high degrees of narrative consistency. In addition, teaching modules might also focus on topics such as text extraction, voice-over/subtitling synchronization, and user interface localization, taking into account creative translation and culturalization.

In Europe, the academic pathways scenarios in software and video game localization is multifaceted and vary significantly across institutions. Some universities offer specialized

master's programs focusing on localization, while others incorporate localization modules within broader translation or game design degrees. In one hand, this diversity reflects the evolving nature of the field, but in the second hand it is possible to observe some difficulties in the standardization of these academic pathways. However, some efforts towards standardizing localization education (especially in Europe) are underway, aiming to create consistent curricula that ensure a high level of expertise. A Standardization procedure might also help to facilitate student mobility and improve the recognition of qualifications in the international arena.

Designing a dedicated course aimed at standardization of localization professionals certainly presents several challenges, such as standardizing specific curricular requirements across different educational systems, ensuring accessibility to the different types of students, and keeping the pace with rapid technological advancements in localization industry.

This section of the study was also supported by an interview (available in Appendix B) with the CEOs of Maneki Commando, a leading video game localization company for the Italian market, providing relevant insights into the industry's expectations from educational institutions. Their perspectives on the skills and competencies required for successful localization professionals highlight the importance of practical experience and industry alignment in educational programs.

6.2.1 The profile of *Game localization* teacher

The profile of a game localization teacher is multifaceted, requiring technical expertise, language skills, and cultural sensitivity, in addition to a natural teaching attitude. Nevertheless, a game localization teacher needs a strong background in both translation studies and computational linguistics, in the attempt to guide students through the complexities of language transfer in interactive media (O'Hagan & Mangiron, 2013). In addition to linguistic skills, technical expertise is relevant; advanced competences in various localization tools are considered essential for dealing with the technical aspects of game localization (Esselink, 2000). Moreover, having familiarity with programming languages and

software engineering fundamentals can certainly enhance a teacher's ability to incorporate localized content into game development (Jiménez-Crespo, 2013).

Practical industry experience would be another important component of the game localization teacher's profile. In this direction, professionals who have experience in localization tasks can provide significant insights into operational practices, challenges, and new trends and methodologies. This experience should allow them to create a more appealing and relevant curriculum that matches industry standards (Bernal-Merino, 2015). Furthermore, the ability to adapt teaching methods to incorporate real-world projects and case studies should help in bridging the gap between academia and industry, preparing students for careers in game localization (Chandler & Deming, 2012).

Cultural competence is also an important resource in the profile of a Game localization teacher. Understanding the cultural differences and socio-linguistic contexts of both the source and target languages would help to produce accurate translations that retain the intent and appeal of the original game. (Mangiron & O'Hagan, 2006). Educators need to help students understand the importance of cultural adaptation by teaching them to recognize and respond appropriately to cultural references, humour, and idioms. (Di Marco, 2007). In addition, soft skills such as communication, project management, and teamwork are relevant, as localization projects often involve working with a large variety of multidisciplinary teams (Esselink, 2000).

In conclusion, a good Game localization teacher would be a comprehensive professional profile with expertise in linguistics, technical skills, practical industry experience, and cultural awareness. Their role is not only to impart knowledge but also to inspire and equip students with the comprehensive skill set required to succeed in the dynamic and challenging field of game localization. Certainly, it could be difficult to find a single profile with all these characteristics, but a solution would be to alternate both academic and professional profile into localization classes.

6.2.2 Educational strategies in video game localization classes

As claimed before, educational strategies in video game localization classes should include theoretical knowledge with practical application to effectively prepare students for the complex and varied demands of localization industry. A comprehensive curriculum could begin by "teaching the basics of translation studies and localization theory to enable students to deal with the underlying principles of language transfer and cultural adaptation in interactive media". (O'Hagan & Mangiron, 2013, pp. 243-275). This theoretical foundation is essential for understanding the complexities of localizing not only text, but also audio, visual elements, and user interfaces. Practical exercises often include real-world projects where students localize segments of actual video games, providing experiential learning that reflects industry practices. (Bernal-Merino, 2015).

Furthermore, collaboration and teamwork are emphasized through group projects that simulate professional environments. These collaborative exercises are critical for developing soft skills such as communication, project management, and problem-solving, which are essential in the localization industry (Chandler & Deming, 2012). Educators should also incorporate guest lectures and workshops involving several companies, putting students in contact with current trends, challenges, and innovations in game localization.

In order to achieve these learning outcomes, localization teachers can use a large variety of methodologies with pedagogical basis. Of course, these methodologies and strategies are subjective, and depend on the types of students and their learning styles. However, it can be possible to identify some of these methodologies to starting with, even in relationship with the nature of localization practices. This research highlighted some teaching methodologies and strategies that would be considered efficient into generic localization classes:

- Communicative and empirical approaches.
- Making students aware of the large variety of operational scenarios.
- Case study approach
- Cooperative learning
- Dividing teaching modules into technical aspects and stylistic strategies

Taking into account the various teaching methodologies adopted, Figure 6.1 shows an example of an effective teaching and learning cycle:

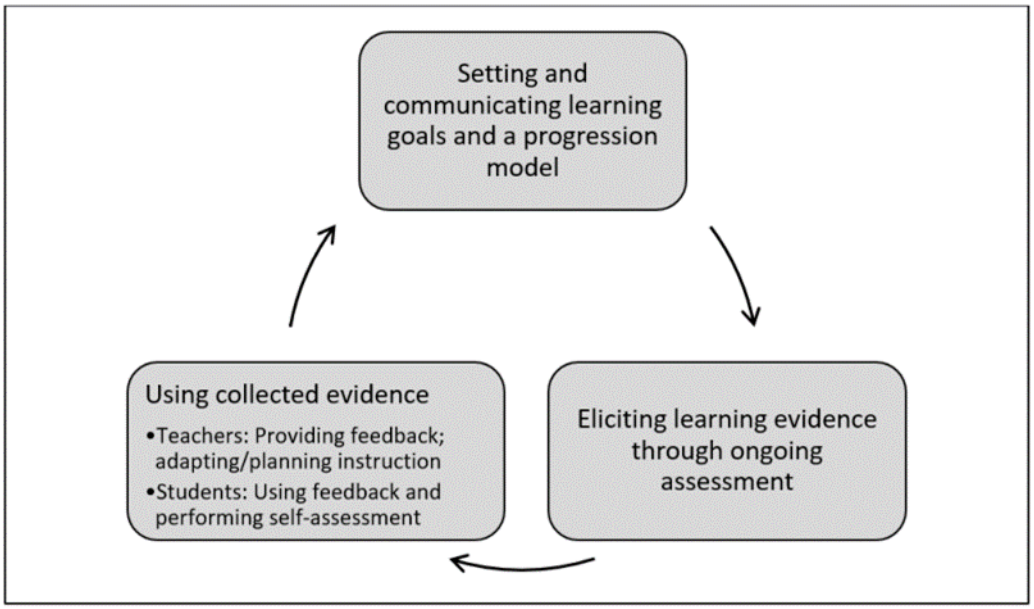

Figure 6.1 Effective teaching and learning cycle. Source: provided by the Author.

In order to properly assess teaching and learning objectives, localization teachers should establish a list of goals to achieve in a progression model that should be given to students. In this way, it would be possible to put students in a context of constant and continue evaluation and auto evaluation, based on a series of feedbacks that can be used to develop metacognitive skills that would be used by students to auto assess themselves to put them in the position to deal with new situations, issues and challenges. Eventually, at the end of each teaching module, teachers should be capable to give students a comprehensible input, which would be required to allow students to learn new contents.

6.2.3 Video game localization teaching modules among technical aspects and stylistic strategies

When it comes to localizing video game content, the adaptation process requires stylistic strategies to maintain the original tone, humour, and intent of the game. In this context, some key stylistic strategies could be taught in localization classes, where students would deal with cultural adaptation, where they would find specific issues to solve, such as references that may not resonate with the target audience, and need to be replaced with

culturally relevant equivalents, or tone adjustment, where the game's dialogue and narrative voice should be aligned with the expectations and norms of the target audience.

For example, a video game's comedic elements can be reworked to fit the target humour style, or some character dialogue can be adjusted or rewritten to reflect local speech patterns and slang, while maintaining character authenticity. In addition, as has been widely reported, localization teams often use creative transcreation, where text is not directly translated, but rethought to evoke similar emotional responses, while maintaining the same level of player immersion and engagement. By adopting the correct stylistic strategies depending on the specific situations, localization not only makes a game understandable in other languages, but makes it also culturally resonant, enhancing the overall player experience.

Furthermore, as localization involves a multitude of items, such as user interface layouts, voice lines, or specific sound effects in the attempt to match both target textual content and player expectations, the importance of consistency across all these elements (such as text, audio, and visual) is crucial for ensuring a cohesive experience that feels natural to the player. Video game localizers should learn how to employ these varied stylistic strategies not only to properly address linguistic differences, but also to bridge a large variety of cultural gaps, by contributing in creating a product that feels both familiar and immersive to players, as the end user experience ultimately enhance the global reach and success of a game.

There is also a strong relationship of interdependence between the successful implementation of stylistic strategies in video game localization and several technical aspects. One of the most relevant technical elements to take into account during localization lessons is the management of text within the game’s code. As this includes the management of variables for text expansion and contraction, the text length can significantly vary depending on the target language; for example, German or Russian translations could have longer text strings compared to English, while oriental languages like Japanese or Chinese may require less space. Also, proper text management requires a dynamic and flexible user interface design that can accommodate these textual variations without disrupting the visual layout or usability. Moreover, implementing a proper support for a large variety of character sets, including non-Latin scripts and bidirectional text for

languages like Arabic or Hebrew, is relevant to ensure accurate and readable text rendering. Technical frameworks must also support a large variety of scripts and diacritics, as well as the ability to switch between different text directions, font sizes, and styles, to maintain a high level of readability and aesthetic consistency across languages.

Another important technical aspect to present in localization classes would be the integration of localized audio, which comprehends the ability of synchronizing dubbed voice-overs with character animations and lips movements. This operation requires precise time coding and sometimes also the modification of character animations to match the pacing of speech in target languages. In these cases, specific technologies such as auto-sync and facial rigging adjustments are often adopted to achieve the proper lip-sync effect, which is particularly challenging when dealing with all those languages characterized by different phonetic structures. In this regard, AI-driven tools are now also capable to change the mouth and the facial expressions of game characters. Then, technical support for multiple audio tracks, subtitles, and captioning options is needed by players who have different preferences and particular accessibility needs. The management of these elements can be made through specific localization software and content management systems designed to handle multiple languages, track changes, and ensure consistency across all localized assets.

In summary, localization testing is a critical technical process that supports stylistic strategies by identifying and resolving issues related to text display, audio synchronization, cultural adaptation, and overall user experience. In this regard, localization teachers should propose testing sessions in simulated environments that reflect the target markets, allowing for the identification of issues or bugs that could affect player experience. In addition, automated testing tools and scripts can also be used to speed up the process, although manual testing remains essential to catch any special issues that require human judgment, such as cultural references. Then, the use of localization kits, which comprehends glossaries, style guides, and translation memories, provides technical support by standardizing terminology and stylistic choices across all translated content. By properly address these technical tools and processes in video game localization classes, future video game localization teams can effectively implement effective stylistic strategies

that ensure the game would be not only linguistically accurate, but also culturally resonant and immersive, properly enhancing the global appeal and playability of the game.

6.2.4 Software and video game localization academic pathways: the European scenario

Video game localization has become an increasingly significant field in the European academic landscape, by reflecting the various linguistic and cultural heritages. In recent years, there has been a growing recognition of the need for specific educational pathways to train new specialized professionals that would face the major challenges in localizing video games for various markets. Both European universities and private institutions are beginning to offer dedicated courses and modules for video game localization, including broader translation and localization curricula. These kinds of academic pathways would cover a large variety of topics, including technical translation, cultural adaptation, software engineering elements, project management, and user experience design, with the purpose to address the multifaceted and complex nature of game localization. For example, several institutions in Countries like Spain, Germany, and the United Kingdom are experimenting new ways to integrate the use of technical tools and collaborative projects with game companies into their study plans, by allowing students to acquire both practical experience and industry insight. Moreover, European academic conferences and publications are dealing with the modern challenges of video game localization, such as the adaptation of culturally specific content, the design and management of non-linear narratives, and the collection of player feedback. Despite these specific advancements, the European academic infrastructure for video game localization continues to face new challenges, such as the need for more specialized programs and the difficulties in standardizing these educational qualifications across different Countries. Nevertheless, the progressive expansion of the video game industry with its cultural impact have motivated innovations in this area, highlighting the importance to introduce new generations of localization professionals trained to meet the modern needs of European and global markets.

The European academic landscape of game localization is clearly expanding, with several academic institutions offering a large number of programs designed in relationship with the growing demand for expertise in this field. For example, the *University of Vigo* in Spain offers a Master's degree in Multimedia Translation that includes teaching modules on video game localization, providing students with practical competences in translating and adapting games for different cultural scenarios. In the same way, the *University of Surrey* in the United Kingdom integrated video game localization modules into its Master of Arts in Translation and Interpreting, merging both the technical and creative aspects of localization for diverse audiences. Then, the *University of Bologna* and *University of Parma* also offers training courses on video game localization within its applied linguistics programs, by dealing with the challenges of interactive storytelling and multimodal texts. In Germany, the *University of Leipzig* includes video game localization aspects in its translation studies degrees, focusing in offering theoretical knowledge and hands-on practice by using industry-based tools. Moreover, the *Universitat Autònoma de Barcelona* and *London's Global University* (UCL) provide a tailored approach through its Master's in Audiovisual Translation, with dedicated training courses in video game and multimedia localization. All these academic programs underline the increasing recognition of video game localization as a stand-alone academic discipline in Europe, although the availability of these pathways can significantly vary among the academic institutions. As time passes, these universities continue to contribute to the development of specialized knowledge and skills necessary for localizing games in a multilingual dynamic environment.

6.2.5 Towards a standardization of localization educational pathways in Europe

As already said, the area of video game localization in Europe is characterized by a diverse and fragmented educational landscape, where academic courses and programs can vary significantly in scope, content, and methodology. This variability presents several obstacles to the standardization of localization education, as there is still no single framework or set of competencies recognized by European institutions. Jiménez-Crespo (2013) points out the need for standardized curricula that meet the evolving needs of the localization

industry, especially at a time when video games represent a relevant cultural and economic sector.

Today, several institutions like the University of Vigo and the University of Surrey offer specialized modules within the area of game studies, but these programs often differ in their approach to practical training and theoretical grounding (O'Hagan & Mangiron, 2013). Then, the absence of any kind of standardized qualifications complicates the mobility of graduates within the European job market, identifying the need for specific educational pathways that refer to the Bologna process for higher education. (Pym, 2012).

A standardization of localization education will not only facilitate the recognition of skills across borders, but will also improve collaboration between academia and the video game industry, in order to create a curriculum that is responsive to technological advancements and market needs. As reported by Bernal-Merino (2015), a standardized educational framework could help bridge the gap between academia and professional practice, ensuring that graduates have a well-rounded skill set that meets industry expectations. Moving in this direction will require a concerted effort by academic institutions, industry stakeholders and policy makers to begin developing recognized accreditation standards and common competencies that reflect the interdisciplinary nature of video game localization.

6.2.6 Designing an international post graduate video game localization course: a proposal with some open challenges

The purpose of this thesis is not to define a standardized localization education system. However, the study would contribute in setting a path in this direction, by proposing some fundamentals about the conception of dedicated academic courses that could present relevant designing elements for standardization purposes.

Designing a postgraduate course focused on game localization requires a multidisciplinary approach focused on linguistic expertise, technical competencies, and cultural sensitivity. Consequently, the curriculum of the course should be designed by comprehending

foundational modules about translation theory, with a focus on audiovisual translation, subtitling, and dubbing, as these elements represent the core of game localization.

Subsequent modules should cover the technical aspects, including file formats, CAT tools, and programming basics, necessary to understand how localization integrates with game development.

An essential teaching module would also be about cultural adaptation, where students learn to face the challenges of rendering culturally-specific elements such as humour, idioms, and character design across different target markets.

Finally, it is important to consider activities aimed at developing practical, hands-on experience; in particular, students should work on real or simulated game localization projects to gain exposure to industry workflows and quality assurance processes. As this work suggests the use of a teaching staff that includes both professionals and academics, collaboration with qualified figures coming from game development, marketing, and voice acting fields will provide students with a comprehensive understanding of the interconnected processes in game localization, preparing them for the dynamic demands of the industry. Given the interdisciplinary nature of these kinds of courses, Master's degrees in both linguistics or computer science should be considered as entry requirements.

This thesis proposes some guidelines that may be useful to consider when designing teaching modules for a postgraduate video game localization course. In this regard, several different progressive phases, each aimed at providing comprehensive knowledge and practical skills, are outlined below:

- **Step 1: Foundation and Theory** teaching modules should introduce students to the principles of localization, taking into account translation theories, linguistics, and cultural adaptation. This step highlights essential aspects of intercultural communication, media translation, and the role of localization in global game markets.

- **Step 2: Technical Proficiency** teaching modules should focus on the technical side of localization, teaching students to work with CAT tools, localization software, file handling, and basic programming fundamentals, which are relevant to game development. This would allow students to learn how to manage localization workflows and handle a large variety of file types, such as text strings, voiceover scripts, and game assets.
- **Step 3: Cultural and Contextual Adaptation** modules should look deeper into the modern issues and challenges that are part of the adapting process of a game for different countries, addressing challenges like humour, colloquial language, and regional laws, which affect the way in which games are received and played.
- **Step 4: Practical Application** teaching modules should emphasize hands-on experience through real-world localization projects. In this direction, students should work in simulated game localization projects, covering all the steps involved, from translating in-game text to quality control checking and testing.

1. **Step 5: Industry Integration** strategies should involve collaboration with professionals from specific fields such as game development, voice acting, and marketing, helping students understand the interdisciplinary nature of localization. This final step should ensure that the students' learning outcomes include both theoretical knowledge and practical skills to work in the rapidly evolving game localization industry.

By following all these reported steps, the course should provide the following learning outcomes:

- Students will be able to localize software products of a large variety of platforms and applications to the linguistic/cultural and technical conditions of target markets.
- Students will acquire knowledge of software development and information technology, be able to analyze software in different development environments, and design and implement the localization workflow.
- Students will become familiar with automated QA procedures and will be able to design specific quality assurance concepts for a large variety of localization

scenarios. They will also develop strong project management skills by gaining experience in managing a variety of localization projects.

- Students will be able to correctly configure parsers in localization tools and solve character encoding problems in cooperation with software programmers/developers. Students will also be able to systematically evaluate and use localization and other specialized software engineering tools.

In the attempt to better define the structure of the course, this research provides an example list of the main academic subjects that could be inserted in the study plan. In order to propose comparative elements regarding the disciplinary fields, Table 6.2 reports the Italian generic scientific disciplinary sectors (SSD):

Table 6.2 Disciplinary fields for Localization courses.

SUBJECTS	REFERENCE ACADEMIC FIELDS (ITALIAN SSD)
Language courses (Preparatory)	L-LIN
Translation Theory	FIL-LET
Computer Assisted Translation Labs	-
Advanced Business Application Labs	-
Industrial Economy	SECS-P
Computational and applied Linguistics	L-LIN
Software Engineering	INF
High-level Programming courses (Preparatory)	INF
Sociology of cultural and communicative processes	SPS

As previously reported, the nature of the selected academic subject is multifaceted and interdisciplinary, comprehending also preparatory courses in both linguistics/foreign languages and high-level programming languages fundamentals. Also, transversal disciplines such as industrial economy and sociology of cultural and communicative processes are recommended, especially to offer students an overview into the dynamics of the localization industry.

6.2.7 A professional register for software localizers?

Another open discussion in the field of software localization is about the establishment of a dedicated professional register for these figures. Creating a professional register for software localizers could bring several advantages to the field, but also some downsides. In Table 6.3 there are reported some pros and cons highlighted by this study:

Table 6.3 Advantages and disadvantages in establishing a professional register for Localization profiles.

PROS	CONS
Standardization of professional profiles	Localizers are still a niche of translation field
Standardization of rates	Registration issues due to specific laws of different Countries
Work connections improvement	Potential issues in international companies recruitment process

First of all, a relevant key benefit is represented by the standardization of these professional profiles, which would help to define reference skill sets and qualifications, enhancing the recognition of localizers in the global market. Consequently, this could also lead to the standardization of rates, ensuring equitable compensation across different regions and projects, which would also simplify budgeting for clients. Additionally, a professional register could improve work connections, allowing localizers to cooperate more efficiently, allowing companies to quickly find qualified professionals.

However, if these advantages are undoubtedly notable, there are also some odds and challenges. In particular, localization remains still today a niche within the broader translation field, and this means that the total number of existing professionals might not be large enough to fully benefit from such a system. In addition, potential registration issues due to specific laws in different countries could complicate the process, as some countries may have strict regulations regarding professional registrations. It could also

create potential problems in the hiring processes of international companies, which may struggle to deal with these legal complexities when hiring professionals in certain countries. Therefore, while a professional register can offer significant benefits, there are some challenges that need careful consideration.

6.3 Localization Engineer and Game localization teacher: two interviews about modern localization professionals and educational pathways

As reported in the introduction of this chapter, this research was also possible thanks to relevant contributions coming from expert profiles of this area. These contributions came from three localization professional profiles that highlighted the key skills required by new profiles, including Localization Engineers and game localization teachers, with also some suggestions for designing dedicated educational pathways.

The first interview was granted by Nicholas Lambson, which is one of the first operational profiles under the area of localization engineering. He is also lecturer at Beijing Language and Culture University, where he deals with automation and machine translation. His contribute has been fundamental on the identification of new trends in software localization, and in particular to better define the profile of Localization Engineer.

The second and third contributes were focused on video game localization and were given by Francesca Pezzoli and Riccardo Lausdei, which are the CEOs of an Italian video game localization team, named Maneki Commando. Besides being specialized professionals, they are also experts in teaching methodologies for video game localization. Their training courses are being conducted in within their company, other than in several Italian Universities, such as Parma and Bologna Universities.

Together with Nicholas Lambson, Francesca Pezzoli and Riccardo Lausdei made possible to identify the major needs and challenges related to localization industry, giving also relevant feedback to build a base structure for designing valuable academic courses in this field.

The full texts of both interviews are available in Appendix B and C.

Discussion

This final chapter has provided a detailed exploration of the evolving landscape of localization industry, in particular within the context of video game localization. Through a dual focus on the development of new professional profiles and the corresponding educational responses, this discussion would incentivize a reflection on the future trends and directions highlighted in the study.

The first section, "New Professional Profiles in the Localization Industry**,**" described how the rapid evolution of technology and the increasing complexity of localization processes have given rise to specialized roles that go beyond traditional localization. These modern professionals need not only a full understanding of localization processes, but also strong capacities for innovation in adapting to new technologies and scenarios, such as nonlinear digital storytelling and SEO localization. These changesets are indicative of a broader trend towards hybrid roles, in which professionals such as Localization Engineers play a relevant part in bridging the gap between localizers and programmers. In this regard, the interview granted by Nicholas Lambson further clarified the understanding of how advanced communication skills and technical proficiency are crucial in managing specific complex localization tasks, particularly in the areas of automation and machine translation.

While localization continues to expand into the area of audiovisual content, the birth of these hybrid professionals highlights the need for continuous adaptation and multidisciplinary collaboration. These changes suggest that the localization industry will increasingly rely on professionals with multifaceted skills to meet both linguistic and technical challenges. The inclusion of these specialized profiles will also require specialized recruitment processes.

The second section, "Teaching Methods and New Educational Pathways in Video Game Localization," highlighted the relevant needs for evolving educational frameworks to prepare the next generation of localization professionals. In particular, the question of Game localization teaching and the examination of innovative learning strategies used in video game localization courses reflected the industry's need for comprehensive education that integrates both theory and practice. The case for international graduate programs and cross-country educational collaborations call attention to the necessity of a global

approach to localization education, particularly considered the international nature of the video game industry.

In this direction, the interview with Maneki Commando's CEO reinforced the importance of creating effective localization teams capable of responding to these evolving needs. Their insights into leadership and team dynamics identified a series of crucial technical skills, but also some needs related to the ability to proper use communication and collaboration within teams. As localization projects have become more globalized and complex over time, professionals and companies that properly support growth and innovation within teams will be relevant to maintaining competitiveness in the localization industry.

In conclusion, the localization industry, particularly in the context of video games, is undergoing a dynamic and rapid evolution, leaded by technological advances and the increasing complexity of global markets. New professional profiles, such as the Localization Engineer, combined with evolving educational strategies are relevant in response to these changes.

As the industry continues to develop and evolve, there will be an increasing need for hybrid professionals that would be capable of merging both technical and linguistic expertise, as well as academic institutions that would be able to adapt to these new requirements. Finally, this chapter underscores the importance of continuous learning, innovation, and collaboration, both professional and academic, to succeed in the future of localization.

Conclusions and future directions

The purpose of this dissertation was to explore the field of digital product localization, with particular reference to the localization of video games, including cross-media and transmedia productions. The study sought to highlight the complexities and challenges involved in ensuring that interactive digital products meet the needs and expectations of different types of users around the world.

Through a comprehensive investigation that included a systematic review of the literature, case study approaches, and methodological analyses, this research has presented and discussed the state of the art of localization practices and has tried to propose new innovative solutions aimed at overcoming some of the major obstacles in the field.

The primary objective of the thesis was to analyse the emerging challenges of software and video game localization, especially in relation to the increasing demand for adaptation of these products in a large number of languages and cultures.

One of the most relevant contributions of this research has been the identification of some critical gaps in the existing body of knowledge, which are deeply linked to the intersection of technology, linguistics, and culture. In this regard, localization cannot simply be considered a process entirely based in translating words from one language to another, but it involves an extremely delicate balance of cultural elements, technical accuracy and creativeness.

Through the adopted systematic literature review methodology, this study has identified not only the main measurable trends and challenges related to localization, but also collected relevant subjective elements, such as the experiences and the point of view of both localization professionals and scholars. Other than relevant for the success of any localization effort, their feedback allowed to collect up-to-date information about the latest trends and directions.

In clarifying and addressing the core issues of localization, this research has reported a comprehensive analysis of the different kinds of tools and methodologies today in use.

Among these, there are translation memories and CAT tools, localization platforms, and specific project management systems.

The rapid evolution of these tools, in response to the industry demands for rapid development cycles and real-time updates, has been identified as both a challenge and an opportunity. In fact, localization professionals have to constantly adapt to new technological landscapes, where AI-driven technologies like neural network and machine learning are becoming more and more pervasive in dealing with large volumes of textual data.

Nevertheless, despite these technological advancements, the study has claimed that human oversight in localization processes still remains necessary, in particular when it comes to the use of creativity in narrative-driven products like video games, where localization must also stimulate appropriate emotional responses in different cultural contexts and situations.

One of the most relevant aspects of this research is represented by an exploration of linguistic dimensions in localization, discussing the main relevant tools and the role of comparative linguistics, micro-languages and parallel corpora. In this regard, these reference linguistic tools provide specific frameworks for understanding some important challenges in adapting textual elements across language that might present a high number of structural differences, such as Italian and English (Benoît Carbone, 2020; Pettini, 2021).

Analysing the peculiarities of specialized sublanguage's lexicon used in highly specific domains such as video game dialogues underlined the level of specialized knowledge required to modern localization professionals, who have to be familiar with various technical jargons, idiomatic expressions, and cultural references associated with the different game genres.

Similarly, the use of parallel corpora, which would be useful to compare translated texts in multiple languages, can improve localization practices ensuring high levels of consistency and accuracy in localized content.

The case studies reported in the thesis further described the practical implications of these theoretical observations. By focusing on three specific video games genres, this research detailed the operational ways adopted by localization teams in facing and managing a large

variety of technical, linguistic, and cultural challenges. Each case study also provided examples, tools and suggestions on how localization practices can be improved through the adoption of innovative technologies, such as AI-driven translation tools and creative strategies that are properly designed to maintain the core of the original content while ensuring that it would be suitable for new audiences. These case studies are also related with the concepts of transmedia and nonlinear storytelling, and they attempted to offer a contribution in pointing the way for new methodologies and operational scenarios.

Beyond both these technical and creative challenges, this work was also focused on broader issues of accessibility and inclusivity in localization. As digital products are becoming even more present in daily life, ensuring their accessibility to users that live with disabilities is crucial. This includes adapting multimedia textual content for users who live with visual, auditory, or cognitive impairments, making also user interfaces and gameplay mechanics inclusive for a wide range of players.

The gender gap in both software and video game localization was also observed, raising relevant questions about the way how the gender representation in digital products can either reinforcing or questioning existing social norms. The need for modern ethical localization methodologies and practices aimed at promoting inclusivity and diversities, was considered as a key element for the future of the industry.

The discussion of these findings led to some important recommendations and operational paths intended for industry professionals and scholars. In particular, this research highlighted the need for multidisciplinary educational pathways where linguistics, computer science, cultural studies, and media production elements would be combined.

As the localization industry continues to rapidly evolve, the demand for professionals that possess these large varieties of skill sets will only increase over time. In this direction, this thesis offered some suggestions for the design and development of dedicated academic programs aimed not only to equip students with proper technical and linguistic expertise, but also to promote cross-cultural communication, project management skills, and elements of user experience (UX) design. These academic programs would train the next generation of localization specialists in facing the complexities of an industry placed at the intersection of technology, language, and culture.

In conclusion, this dissertation has provided an investigation of the new challenges in software and video game localization. As the study addressed both technical and creative aspects of localization, apart from ethical issues related to accessibility and inclusivity, its findings would be relevant to a wide range of stakeholders in the field. In particular, this work attempts not only to contribute to the state of the art in localization theory and practice, but also provides some practical suggestions for both industry professionals and educators.

Anyway, this research faces several limitations. First of all, localization studies often do not provide a comprehensive integration of translation studies with technical disciplines such as software engineering, and this gap may hinder the development of comprehensive teaching methodologies. In addition, both teachers and researchers may have difficulty accessing localization tools and software used in the industry, which affects their ability to replicate real-world scenarios in educational settings.

Thus, the rapid evolution of localization technologies, such as AI-driven translation systems, makes it difficult to establish up-to-date curricula. In fact, many programs do not always address the latest tools and technology needs.

Addressing these limitations would require greater collaboration between academia and the localization industry, broader access to state-of-the-art tools, and a stronger focus on interdisciplinary research methodologies. In this direction, future research could explore internship programs, collaborative workshops, or the use of industry-specific case studies in the classroom to ensure that students gain practical, real-world skills.

As digital products continue to play an important role in our interconnected world, the need for flexible and competent localization professionals will surely increase, making the insights and suggestions presented in this study more relevant than ever.

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Appendix A – Meta analysis results

Title	Relevance (0-5pt)	Availability (0-1pt)	Main localization method/field of studies	Issues and challenges	Specific comparative linguistic studies
Abufardeh, S., & Magel, K. (2008). Software localization: The challenging aspects of Arabic to the localization process (Arabization). In *Proceedings of the IASTED International Conference on Software Engineering (SE 2008)* (pp. 275-279). IASTED.	3	1	Unicode	Improvements for a better support of Arabic in software localization	N/A
Pastor, F. A. M. L. C. (2015). On the categorization of seem and its Spanish renderings. Revista Signos, 48(88), 154-173.	3	1	N/A	N/A	Categorization of the values of seem in a parallel corpus of technical content in English and Spanish
Bernal-Merino, M. Á. (2014). Translation and localisation in video games: Making entertainment software global (1st ed.). Routledge. https://doi.org/10.4324/9781315752334	5	1	Discussion on reference techniques in game localization: Cat tools, Unicode, translation memories and AI-driven technologies	Technical and economic suggestions for game localization	N/A
Heyn, M. (2016). Translation memories: Insights and prospects. In Unity in diversity: Current trends in translation studies (pp. 123-136).	4	1	Translation memories	Definition of efficient cultural adaptation models for digital translation	N/A
Budin, G. (2006). Localization. In Encyclopedia of language & linguistics (pp. 290-291).	5	1	Translation memories	Improvements of Internationalization processes	N/A
Chiang, H.-C., & Hu, K. (2015). A multi-lingual management process for software interface consistency. In *Frontiers in Artificial Intelligence and*	5	1	Terminology repository system	Establishment of a terminology repository system for	N/A

Applications (Vol. 274, pp. 2193-2196). IOS Press.				machine translation	
Dagiene, V., & Jevsikova, T. (2009). Cultural elements in Internet software localization. Revue d'Intelligence Artificielle, 23(4), 485-501.	3	1	Phrase-based query translation model	Implementation of cultural elements, not yet included in existing locale models	N/A
Dagiene, V., & Grigas, G. (2006). Quantitative evaluation of the process of open-source software localization. *Informatica, 17*(1), 3-12.	5	1	Resources string translation	Quantitative evaluation of dependency between number of strings in software localization	N/A
Dos Santos, C. A. C. D., & Oliveira, S. M. (2017). Databases internationalization model. In Proceedings of the Iberian Conference on Information Systems and Technologies (CISTI 2017).	5	1	Internationalization related to databases	Definition of a new model to reduce internationalization costs	N/A
Estrella, P., Bruno, L., Perassi, M. L., Mora-Lezcano, V., & Chacón-Rivas, M. (2019). Software localization: The case of the EULER editor. In Proceedings of the 14th Latin American Conference on Learning Technologies (LACLO 2019) (pp. 1-7).	5	1	Internationalization for mathematical software (case study)	Introducing linguists into the location industry	N/A
Karkaletsis, E. A., Spyropoulos, C. D., & Vouros, G. (1995). The use of terminological knowledge bases in software localisation. In *Lecture Notes in Computer Science* (Vol. 898, pp. 175-188). Springer.	3	1	Terminology mamagement (case study)	Definition of a knowledge representation scheme for CAT Tools	N/A
Kingscott, G. (2002). Technical translation and related disciplines. Perspectives: Studies in Translatology, 10(4), 247-255.	4	1	Translation memories	Improvements in technical translations and definition of new skills for translators.	N/A

Mangiron, C., & O'Hagan, M. (2006). Game localization: Unleashing imagination with 'restricted' translation. The Journal of Specialised Translation, 6, 10-21.	5	1	Linguistic variation technique (Molina and Hurtado, 2002)	Definition of new localization approaches to improve gameplay experience	N/A
Mendiluce-Cabrera, G., & Bermúdez-Bausela, M. (2006). Sci-tech communication: Is there a process of internationalization in English and Spanish? *Meta, 51*(3), 445-458.	4	1	N/A	N/A	Diatopic variants in sci-tech written language
Muntés-Mulero, V., Adell, P. P., España-Bonet, C., & Màrquez, L. (2012). Context-aware machine translation for software localization. In *Proceedings of the 16th Annual Conference of the European Association for Machine Translation, EAMT 2012* (pp. 77-80). European Association for Machine Translation.	4	1	Translation memories	Adapting translation memories to exploit contextual information	N/A
O'Brien, S. (2016). Practical experience of computer-aided translation tools in the software localization industry. In Unity in diversity: Current trends in translation studies (pp. 115-122).	5	1	CAT Tools	Improvements od CAT Tools	N/A
Ranta, A. (2009). Grammars as software libraries. In From semantics to computer science: Essays in honour of Gilles Kahn (pp. 281-308).	5	1	Translation memories	Creating grammar libraries specific content to translate	N/A
Ressin, M., Abdelnour-Nocera, J., & Smith, A. (2011). Lost in agility? Approaching software localization in agile software development. Lecture Notes in Business Information Processing, 77, 320-321.	4	1	CAT tools	Definition of new cultural adaptation approaches in software localization	N/A

Rodríguez-Castro, M. (2018). An integrated curricular design for computer-assisted translation tools: Developing technical expertise. Interpreter and Translator Trainer, 12(4), 355-374.	5	1	CAT tools	Definition of new skills and competencies for modern translators	N/A
Saha, G. K. (2008). On localization of enterprise information system. In IFIP Advances in Information and Communication Technology, 254(1), 545-551.	3	1	XML based Computational Linguistics Markup (CLM)	Improvements of internationalization processes	N/A
Skadiņš, R., Pinnis, M., Vasiļjevs, A., Skadiņa, I., & Hudik, T. (2014). Application of machine translation in localization into low-resourced languages. In Proceedings of the 17th Annual Conference of the European Association for Machine Translation, EAMT 2014 (pp. 209-216).	4	1	Machine translation	Improvement of support for low-resourced languages	N/A
Soh, M. (2018). Towards a model of integration of underserved cultural factors in software by reverse localisation: Case study in Yemba culture. In Lecture Notes of the Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering (LNICST 204, pp. 222-233).	4	1	CAT tools	Improvement of support for low-resourced languages	N/A
Sviridova, T., & Fadyeyeva, K. (2023). Software localization: Translation memory using.	5	1	Translation memories	Standardization of internationalization for cost savings	N/A
Tomar, V., & Bhatia, M. (2015). Software localization kit for Indian mass. In Proceedings of the 2014 IEEE International Symposium on Signal Processing and Information	3	1	Unicode and java	Special characters and software localization in Hindi language	N/A

Technology (ISSPIT 2014). https://doi.org/10.1109/ISSPIT.2014.7300596					
Wakabayashi, J. (2016). Marginal forms of translation in Japan: Variations from the norm. In Unity in diversity: Current trends in translation studies (pp. 57-63).	3	1	CAT tools	Definition of the advantages of CAT tools over machine translation	N/A
Wang, X., Chen, C., & Xing, Z. (2019). Domain-specific machine translation with recurrent neural network for software localization. Empirical Software Engineering, 24(6), 3514-3545.	3	1	Machine translation and neural networks	Definition of new approaches in AI-driven localization technologies	N/A
Wilson, H., & Shaw, M. J. (1984). Designing software for the international market. Hewlett-Packard Journal, 35(9), 31-35.	5	1	Unicode	Use of extended ASCII characters	N/A
Yao, Y. (2010). An ontology-based translation memory model in localization translation. In Proceedings of the 2010 Third International Symposium on Information Science and Engineering (ISISE '10) (pp. 340–344). IEEE. https://doi.org/10.1109/ISISE.2010.37	4	1	Translation memory tools	Applying ontologies in localization	N/A
Sajna, M. (2016). Video game translation and cognitive semantics. Peter Lang.	5	1	Cognitive semantics and game localization	Redefining the translator role in game localization	N/A
Aarseth, E. (1997). Cybertext: Perspectives on ergodic literature. Johns Hopkins University Press.	5	1	Digital literature related with interactive and nonlinear storytelling	Definition of theoretical models in approaching to both paper and digital text	N/A
Pettini, S. (2021). The translation of realia and irrealia in game localization: Culture-specificity between	5	1	Impact of realism and fictionality in game localization	Localization approaches in balancing the degree of realism and	N/A

realism and fictionality. Routledge.				fictionality in digital games	
Jenkins, H. (2006). Convergence culture: Where old and new media collide. New York University Press.	5	1	Crossmedia storytelling	Analysis of media forms in digital productions	N/A
Cremin, C. (2015). *Exploring videogames with Deleuze and Guattari: Towards an affective theory of form*. Routledge.	5	1	Philosophy and emotive response in video games	Deleuzian approach in game theory	N/A
Perron, B. (2016). Video games and the mind: Essays on cognition, affect and emotion. McFarland Publishing.	5	1	Psychology and emotions in video games.	Defining relevant aspects of emotional response in digital storytelling	N/A
Bernal-Merino, A. (2018). Creativity and playability in the localisation of video games. The Journal of Internationalisation and Localisation, 5(1), 101-137.	5	1	Creativity and gameplay experience in game localization	Definition of creativeness parameters in interactive storytelling	N/A
Non-indexed results					
Title	**Relevance (0-5pt)**	**Availability (0-1pt)**	**Main localization method/field of studies**	**Issues and challenges**	**Specific comparative linguistic studies**
de Pedro Ricoy, R. (2007). *Internationalization vs. localization: The translation of videogame advertising* (Unpublished thesis). Heriot-Watt University.	4	1	Internationalization and localization	Multilanguage support in game localization	N/A
Erbil, M. (2021). *Localization factors of video games and impacts on digital purchasing behavior* (Master's thesis). Istanbul Bilgi University.	4	1	Advertising and game localization	Marketing approaches in game localization	N/A
Lepre, O. (2015). The translation of humor in video games: A case study [Doctoral thesis, University College London].	4	1	Humor and game localization	Comparative linguistics and localization strategies	Parallel corpus analysis of two videogames
Salmerón, A. G. (2018). *The process of video game*	4	1	Game accessibility	Accessibility and	N/A

localization: Issues and types (Master's thesis).				localization strategies	
Eriksen, M. (2018). *The cultural aspect of video game regulation practices: A comparative study of the differences in video game rating practices between Europe and Japan* (Master's thesis).	3	1	Child safety, personal expressions and cultural differences in game localization	Transparency measures in content related aspects in game localization	N/A
Erbil, M. (2021). *Localization factors of video games and impacts on digital purchasing behavior* (Master's thesis). Istanbul Bilgi University.	3	1	Globalization and video games	Issues in localization and distribution of digital products	N/A
Justyna, L. (2020). *Fantasy role-playing games in translation: An analysis of The Witcher 3: Wild Hunt* (Master's thesis). Lambert Academic Publishing.	4	1	Case study on "The Witcher 3: Wild Hunt"	Analysis of the strategies employed to localize game dialogues	N/A
Mintchev, A. (2021). *Applying videogame narrative design and level design to museum exhibit design* (Doctoral dissertation). University of Brighton.	3	1	Narrative and level design in video game industry related with museums	Design and translation lessons for the creation of exhibits	N/A
Krylov, A. (2020). *The growing influence of English as the language of video games and films* (Bachelor's thesis). Tallinn University.	4	1	Influence of English language in game localization	Disadvantages in using English as reference language in game localization	N/A
Muñoz Sánchez, P. (2021). *Video game localisation for fans by fans: The case of romhacking* (Doctoral dissertation). Universitat Rovira i Virgili.	4	1	Romhacking and localization	Impact of fandom localization in video game industry.	N/A

Appendix B – Interview to Maneki Commando CEOs: Francesca Pezzoli and Riccardo Lausdei

Marco Pirrone: Today the professional profile of video game localizer is still difficult to find, although it is highly requested by the video game industry. Can you explain why?

Francesca Pezzoli and Riccardo Lausdei: Today, the field of video game localization is rapidly evolving, and the localization industry is constantly looking for video game localizers. Until the first decade of the 2000s, it was more difficult to find this professional profile, mainly due to the lack of information about localization. It is only in recent years that the first educational pathways in this field have been created.

Today, more and more people are applying for jobs in this field. This is also due to the fact that the medium of video games is no longer considered a mere form of entertainment for children; in fact, younger generations are aware that the video game industry is now a well-established reality that offers promising job opportunities.

Therefore, several people often decide to attend special localization training courses. Perhaps one of the most relevant problems is that most people, usually driven by enthusiasm, try to get hired as video game localizers, so many of them do not succeed. For example, almost 10-20 percent of our students find jobs in the localization industry.

Marco Pirrone: Although the presence of some academic courses specifically designed to train the profiles of video game localizers, a general lack of both technical and operational skills is still reported by the localization industry. Why?

Francesca Pezzoli and Riccardo Lausdei: It is certainly true that until a few years ago, the video game localizer was a sort of self-made translator, probably coming from other fields of translation. As a result, the necessary skills were often acquired on the job. Others took a different path, perhaps coming from the gaming industry in general, perhaps as journalists or product distributors. In this case, these people already possessed skills in the

interactive entertainment field, but not in the operational methods of localization. Localizing a video game is very different from translating a manual or a novel, and there are several elements to recognize and pay attention to, such as the code strings of programming languages.

Today, those who do not possess basic skills are unlikely to be hired by localization agencies or companies, which now have less need to invest in internal training for new video game localizers. In any case, continuous training in the field is always required, since the operating methods in this area evolve and change very rapidly.

As far as training courses are concerned, their presence is growing, especially as post-graduate courses; however, the courses are not standardized, especially at international level. In Europe, the situation is parallel for the Italian, French, and German Countries, while in Spain these pathways are outnumbered and structured in different ways since more funds are invested in this sector. So, the scenario can vary depending on the area.

Marco Pirrone: What kinds of educational strategies would you use in setting up academic pathways meant for game localizers?

Francesca Pezzoli and Riccardo Lausdei: The starting approach that we use in our courses consists in putting our students directly in front of the texts to adapt, with the aim of proposing then specific translation strategies.

In our opinion, this pragmatic approach helps out to create the best possible operational context. Unfortunately, obtaining these texts directly from our customers could not be easy, as materials are often subjected to non-disclosure agreements. In this regard, we always propose texts taken from already released games, once obtained specific authorizations to use them.

Furthermore, each software house adopts different approaches to game localization, due to the use of distinguished idiosyncrasies, placeholders, variables, etc. As there is not any standardized way to localize videogames, we prefer to put our students directly in real and practical operational scenarios.

This allows us to make the students aware of the most common issues and challenges in this field, making also possible to analyse the adopted translation strategies. Starting with these considerations, we can use and calibrate the appropriate teaching strategies for each specific situation.

In this regard, we usually develop our teaching modules considering technical aspects (software to use, placeholders, file formats, etc.) and stylistic strategies (translation of idiomatic expressions, puns, semantic nuances, etc.).

Marco Pirrone: In your opinion, how would you describe the profile of a good game localization teacher?

Francesca Pezzoli and Riccardo Lausdei: We believe that a good video game localization teacher should also work in the industry because things evolve very quickly. Furthermore, a purely theoretical approach, even if valid, is not enough and does not last long over time. An example of this could be related to the rapid evolution of the software used in localization. From products like *Trados* we have moved, in the space of a few years, to more evolved tools, such as *MemoQ*. For this reason, the teacher must therefore be updated on the evolution of the reference techniques and instruments, also keeping up to date on teaching methodologies applied to ever new situations.

Unlike some sectors, where practical application is optional, video game localization requires a pragmatical, constantly evolving approach (for example, video game manuals are no longer localized because they no longer exist). In this regard, we are often forced to update teaching materials even every six months. Consequently, each student who takes a video game localization course should possess or develop a practical approach.

Of course, we don't assume that localization can only be taught by professionals. It is necessary to possess skills in teaching methodologies to convey the contents correctly. Otherwise, there is the risk of teaching lessons entirely based on the description of anecdotes or situations (an example in this sense could be that of a great musician who is not able to teach music). For this reason, we believe that is necessary to have teaching experience or at least an attitude for teaching, while remaining an active professional in the sector.

Marco Pirrone: Do you think that cooperation between academia and industries should lead to the birth of a professional register of software and game localizers? In this case, would you include both linguistics and computer science degrees among the access requirements?

Francesca Pezzoli and Riccardo Lausdei: We believe that a professional register for software and video game localizers is not easy to arrange. Hypothetically, a professional register might be conceivable at a supra-national level, since otherwise there would be too small numbers. However, we argue that the localization sector still represents a niche of the translation field.

Furthermore, establishing a professional register in individual countries could also lead to potential issues in the companies' recruitment process. In fact, in each Country, there are specific laws and canons that regulate the various professional profiles.

However, there is periodic talk of establishing a professional register for software localizers, although there is not yet even a register for translators.

There is also talk of establishing a trade union since this already exists for translators. In any case, since localization is undoubtedly an international job, it could certainly be useful to have a supranational professional register. In any case, a register would also contribute in trying to standardize rates for localization tasks.

Talking about the entry requirements for this professional register, we do not believe that a video game localizer should possess a degree in Computer Science. However, we suppose it would be an advantage if localizers also had additional IT skills.

In this direction, new professional profiles could be created and placed in the localization industry. Also, even emerging figures could be better defined. Among these profiles, we highlight the figure of the localization engineer, who is responsible for planning and executing a workflow for exporting, translating, and re-integrating content for application software, websites, and video games. In this regard, as there is not yet any standardized training path to become a localization engineer, computer science or hybrid degrees in the

areas of linguistics and Information Technologies can represent some relevant possible requirements.

Appendix C – Interview to Nicholas Lambson

Marco Pirrone: Can you briefly describe the role of Localization Engineer professional profile within application software and game industries?

Nicholas Lambson: A localization engineer facilitates the technical parts of a localization project. In particular, for websites, games or apps, and from my perspective, a localization engineer can work either on the client side, or on the vendor side. Also, a Localization Engineer can work for a language service provider (a company that that provides localization services), and my experience comes exclusively from the vendor side. So, that means I'm familiar with providing localization services for a range of different clients, whether it's for video games, applications, or websites.

Marco Pirrone: In your opinion, what kinds of technical and communicative skills should be possessed by Localization Engineers, especially in order to act as *bridgers* profiles between programmers and localizers?

Nicholas Lambson: We can divide the skills of a localization engineer into soft and hard skills. Among the technical skills, the localization engineer should understand content types. This means understanding the content that customers typically send to the company.

When you work as a localization engineer on the vendor side, you see a wide variety of projects and content types.

It could be anything from traditional files like Microsoft Word documents, Excel documents, PowerPoint files, but it could also be other things like publishing documents, such as Adobe Indesign or Illustrator.

There is also technical documentation, software like MadCap flare, or software strings for Android or iOS. It could be Java strings. It could be web content such as HTML, JavaScript, and CSS. There's also XML and XHTML. And sometimes, localization engineers should be

familiar with game development software. One example is Unity, which is a big game development platform, but there are also other platforms like *GODOT* and *Clickteam Fusion*. Then, there is also video localization. Engineers should be familiar with handling videos that include subtitles and captions in *SRT* format and all different kinds of fonts and encodings. The localization engineer should understand internationalisation best practises and all kinds of file types that are used in localization, including *XLIFF*, *TMX* and TBX (*TermBase eXchange)*.

So, these are the different content types that a localization engineer should understand. You don't need to know all of them, but you should be familiar with the ones that you have to handle for your clients.

As for tools, localization engineers should understand how to use CAT tools like *memoQ,* and also *Translation Management Systems* (TMS), such as *RWS World Server*, *XTM* or *Phrase*. These kinds of server-based systems allow for collaboration and centralised storage of linguistic assets.

In addition to translation memories and terminology, an engineer should also understand and manage other types of tools used in localization, such as *ApSIC Xbench*. There are also open-source tools for software localization, such as *Okapi*'s *Rainbow*.

An engineer should be familiar with machine translation systems and large language models, by understanding data collection, data cleaning, and system training. Prompt engineering can be a big part of the localization engineer's role if they are creating automated scripts that will check for quality issues in translated files.

Then, there are also the enterprise systems that are in use by clients and language service providers. An enterprise system could be something like Microsoft SharePoint, or someplace where files are stored, or an enterprise tracking system or business management system. There are a couple of commercial systems in the localization industry that serve this function, including *XTRF* or *Plunet*.

In addition to these important tools, I believe that an excellent localization engineer should also be an excellent programmer, especially with Python. I think Python is the most appropriate choice of programming language for localization engineers, not only because it is so widely used in natural language processing, machine learning, machine translation, and AI, but also because it is relatively easy to get started and learn the basics to be

productive in localization tasks.

Python is great because it is a high-level programming language with an appropriate level of abstraction, allowing to work in a productive environment where on-time delivery is paramount. Python allows you code up tools very quickly in comparison to low-level programming languages like *C++*, which is more effective for optimizing processing speed, but it doesn't economize the developer's time on time-sensitive production projects.

Of course, a localization engineer should understand how to use regular expressions to match patterns of text.

In this regard*, Visual Studio* code is my preferred integrated development environment (*IDE*). I use *GitHub* and the command line, and for Excel and Word, I use Visual Basic for Applications (*VBA*). I also use Microsoft PowerAutomate for automating SharePoint workflows. So, in conclusion, those would be the main technical skills that should be possessed by localization engineers. You don't have to know all of them all at once, but you have to be familiar with the ones that will be used on the projects that you're taking care of.

Now, I will list some soft skills I think should be acquired by localization engineers.

First of all, it would be helpful to understand how to estimate the amount of necessary work to complete a project. And when you do this, you might give a best case and worst-case scenario. For example, you might say: “OK, it could take up to five hours to do this task”, or “it could take as little as three hours”, so that you can provide an estimation range.

Then, a localization engineer should be able to analyse data and present it in a compelling way. In this respect, the skillset of data science is quite applicable to localization engineer about the way how to handle data, process it, analyse and present it.

Also, it's very useful to clearly document your own processes in the company's knowledge base. This should be done for any projects you work on. In particular, a localization engineer should record all the steps for a specific project, including how to run the tools that will be used. In this way, the engineer’s colleagues will have no problem taking over that project in his absence. In this regard, writing process documentation can be considered the same skill as technical writing. So, a localization engineer should be a good technical writer of being able to write their own processes, but should also be comfortable asking their coworkers for help. In this way, a localization engineer could be a kind of project manager

for engineering projects. In particular, the engineer can clearly document the requirements of projects, set milestones, assign people to the task, and monitor progress, becoming a manager of other engineers and making sure that a project is taken care of.

When a localization engineer works on a large-scale project, there may be several dozen languages and hundreds or even thousands of files.

In this case, the engineer should be able to track their progress, because not all languages or linguists perform their work at the same rate. During the course of a project, localization engineers are responsible for troubleshooting technical issues that are encountered by project managers and translators.

Of course, a localization engineer is human, and we all make mistakes. For this reason, a localization engineer should be able to take ownership and responsibility of their own mistakes, preventing also the issues from happening again. When talking about this, it can be useful to create a document called *Root Cause Analysis* (RCA), with also a *Corrective Action Report* (CAR). These documents are essential components of process and quality management in an ISO 9001 certified company.

Another soft skill that should be possessed by localization engineers is familiarity with all different kinds of languages. For example, if I asked you to explain the difference between Mandarin Chinese and Cantonese and simplified Chinese and traditional Chinese, would you be able to do it? Mandarin and Cantonese are spoken variants of Chinese, and Simplified and Traditional are written forms of Chinese. Non-Chinese speakers are often surprised to discover that the correlation between Mandarin and Simplified Chinese, and between Cantonese and Traditional Chinese, is not as straightforward as they might assume.

Finally, a localization engineer should be familiar with the orthography of various writing scripts, in order to find linguistic issues that should be explained or clarified to the client or the translators. So, this is a range of technical and soft skills that I think are very important for localization engineers.

Marco Pirrone: Can you mention some reference support tools and operational approaches which can be useful during localization engineering tasks?

Nicholas Lambson: My advice for localization engineers is to learn *Python*. As you learn Python, you should also be familiar with CAT tools. There's another tool called *Okapi Rainbow* which is quite effective. Also, improve your skills with prompt engineering. I think these skills will be most beneficial as you progress in career as a localization engineer.

Marco Pirrone: Can you briefly describe some of the main open challenges in this field?

Nicholas Lambson: Yes, I can name a few challenges. First of all, localization professionals need to know as much context as possible about a project. When localizing a website, video game, or application, it is necessary to see how the localized text will fit into the overall context. This is particularly useful in video game localization projects, where digital characters are part of stories and narrative universes. Unfortunately, the tools available in the localization industry are not conducive to presenting context.

Another challenging task is related to the integration of machine translation and AI-driven technologies into localization workflows. These are incredible tools, but you can't just plug them in wherever you want. You have to understand where they would be helpful and where they would be detrimental. For this reason, localization professionals need to understand the performance that different machine translation engines have for certain languages or micro-languages, understanding also the risk tolerance of clients. In this regard, it can be possible to use algorithms like *BLEU,* which are capable of measuring (by giving a score from 1 to 100) how closely machine translation matches a human reference translation. Assigning a score to translation would be useful to identify the bad ones.
Some *Translation Management Systems* (TMS) and *machine translation aggregators* like *Intento*, have a lot of connections to all different kinds of machine translation engines worldwide, such as *Google, Microsoft, Amazon, Alibaba, Baidu, Yandex, Deepl* etc. In this way, localization engineers can use the best engine for a specific content type and domain. Another alternative is custom machine translation software, with a wide range of tools for performing and cleaning machine translation training data with the aim to elevate the quality of raw machine translation.

Another challenge is related to the management of source file formats received from clients. In fact, not all file formats would be suitable for all kinds of projects, and sometimes localization professionals need to go back to the clients asking to change them.

Then, an important challenge to face for localization engineers is to pursue automation through programming and writing documentation about their own processes. Unfortunately, not all localization engineers are great programmers or great technical writers, so there is the need to create some functional approaches in this direction.

In conclusion, one last challenge for localization engineers is related to the large variety of projects and content types to deal with. In fact, acquiring technical familiarity with each of those content types requires a lot of training and time. In this regard, the presence of specific academic pathways would contribute to face this issue.

Marco Pirrone: How would you suggest to create a standard framework for this professional profile? What kinds of degrees and/or other entry requirements would you consider?

Nicholas Lambson: It is a great question because when you go to university, you can't get a degree in localization engineering. Anyway, you can get a degree in software engineering, computer science, or in linguistics. It's not very common to find a degree that combines those two unless you know you’re mixing and matching different courses. So, considering localization engineering requirements, I would design a course which would be mainly focused on technical skills (probably 80%), and language skills (about 20%).
In this regard, I observed that localization engineers working on the client side have a different background from who work on the vendor side. In particular, engineers on the vendor side are likely to come with a language degree and added some technical skills to their linguistic competences. In the opposite way, engineers that work on the client side typically graduated in computer science or software engineering.

Like I said, there is still not a dedicated degree programme, but, talking about entry requirements, computer science, software engineering, information technology,

information systems would be some valuable degrees as they combine technology and business with also data science methodologies.

Then, on the language side there are foreign language studies, translation studies, and linguistics. Localization engineers should be familiar with computer-aided translation tools (CAT), corpus analytics, natural language processing, and computational linguistics. These courses will be really quite effective because they combine language with computing. If I were to design a university program specifically for training localization engineers, I'd envision either a four-year bachelor's degree or a dedicated postgraduate course that included the following courses:

- Computer assisted translation tools.
- Advanced business applications.
- Industrial economy.
- Python programming (preparatory courses for 4 semesters).
- Natural language processing.
- Data science.
- Linguistics and translation theory.
- Localization engineering using Python (Duration: 2 semesters).

Of course, I won't list all the courses that I would have and I'll send a list later. But I think that this would be the best way to arrange a programme.

I believe programming skills are critical. When I started working as a localization engineer, I didn’t know Python at all. But I quickly learned the value of it. I took every opportunity to automate even the smallest of tasks. My supervisor encouraged me at every step. Now, I consider myself an expert in automating localization tasks with Python. I’ve developed dozens of tools, some of which are full-fledged software with a graphical user interface and connections to online services via API on the back-end.

I also attained my PCPP certification, which is the highest Python programming certification available. The Python Institute's certification programs are a good place to start learning Python. There are basically three levels: PCEP (entry-level), PCAP (associate-level), and PCPP (professional-level).