

Computer-assisted Interpreting: Challenges and Future Perspectives

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Abstract

During the last decades, information technology has played a central role in the language services industry. Translators and technical writers take advantage of dedicated software to reuse already translated texts, to adhere to a customer-specific corporate language, to grant terminology consistency, and so forth. The final goal is to increase quality and productivity. Even if information technology did not have the same impact on conference interpreting, also the profession is undergoing some changes. Computer-assisted interpreting (CAI) tools have entered the profession only in recent years, but other, more general resources had already influenced the way interpreters work. This is not only challenging the way interpreting is performed, but it may have an impact on the cognitive processes underlying the interpreting task, even on some basic assumptions and theories of interpreting, for example the cognitive load distribution between different tasks during simultaneous interpreting. Yet, the academic debate is starting to take notice of these changes and their implications only now. As a consequence, it almost failed to shed light on and address the challenges that lay ahead: there have been relatively few empirical investigations on the impact of CAI tools; interpreting models have not been adapted accordingly; the didactics of interpreting has received almost no new technologies in their curricula and no proposal has been advanced to increase the quality of CAI tools and to meet interpreters' real needs.

Keywords

computer-assisted interpreting – productivity – CAI tools – information technology – interpreters – interpretation

1 Introduction

During the last decades, Information and Communication Technology (ICT) has played a central role in many language-related professions: translators and

technical writers take advantage of dedicated software to reuse textual parts or already translated sentences, to adhere to a customer-specific corporate language, to grant terminology consistency, and so forth. With their final goal to increase quality and productivity, the use of such tools has become so ubiquitous that their presence is mostly taken for granted.

On interpreting, however, ICT did not have the same major impact as on other professions, as confirmed by the fact that the manner in which interpreting is performed today has basically remained the same over the years. Yet, the profession also underwent some important changes with regard to new technological advances. The World Wide Web with its unprecedented richness of subject and terminological information, for example, has changed the way interpreters prepare their assignments (cf. Kalina, 2009; Fantinuoli, 2011), allowing them to deal more effectively with the complexity and variability of the topics they are called upon to interpret (cf. Tripepi Winteringham, 2010). Laptops and tablets in the booth allow interpreters to look up reference material and specialised terminology while interpreting (cf. Fantinuoli, 2016b; Costa et al., 2014, this volume; Will, 2015), with implications both on the cognitive processes underlying the interpreting task as well as on the preparatory activity needed to perform well. Finally, the use of remote interpreting has been adopted in some interpreting settings and its diffusion is increasing (cf. Moutourakis, 1996; Riccardi, 2000; Andres and Falk, 2009).

Notwithstanding the above-mentioned uses of technology in the modern interpreting workflow, the attitude of many practitioners towards interpreter-specific technologies is rather negative. The fact that many of them have shown some degree of reluctance to the use of ICT (cf. Tripepi Winteringham, 2010) is illustrated by the results of several surveys in professional settings (cf. Berber-Irabien, 2008; Valentini, 2002) and individual papers (cf. Roderick, 2014).¹ Pym (2011: 4) describes the general attitude of professional interpreters towards technological transformation with the following words:

IBM headphones and wires enabled conference interpreters to form a profession [...] So what happens when the technology moves to the next level, in this case allowing for remote video-interpreting [...]. The established conference interpreters will swear until they are blue in the face that quality work only comes from their being in attendance at the conference, to witness the speaker's every gesture, to imbibe the atmosphere

1 Roderick (2014, 18), for example, repeatedly speaks of 'alienation due to the use of new technology' and that '[IT in the booth] can lead the interpreter to lose sight of the first aim of interpreting as we learn it, namely conveying meaning and facilitating communication'.

of the event, to hobnob with the eminences they are called upon to render. No matter the empirical evidence for or against, the professional group that gained its mystique with an old technology will resist the advance of the new technology, at least until it can turn the new to suit its own strategic purposes. Resistance to technological change is usually a defense of old accrued power, dressed in the guise of quality.

The lack of interest for or the aversion to new technologies is not only limited to the practitioners. Judging by the small number of studies on technologies published to date, a similar attitude seems also to be typical for the academic debate, as I will point out in Section 2.

When discussing ICT in the field of interpreting it is important to differentiate technologies depending on the level at which they interact with the interpreter and the interpreting task. I would like to propose a clear distinction here between two groups of technologies which I will call, for lack of better terms, the process-oriented on the one hand, and the setting-oriented technologies on the other. The first group comprises terminology management systems, knowledge extraction software, corpus analysis tools and the like. They are process-oriented because they are designed to support the interpreter during the different sub-processes of interpreting and, consequently, in the various phases of an assignment, i.e. prior to, during and possibly after the interpreting activity proper, independent of the modality. They are an integral part of the interpreting process and are directly linked to and might have an influence on the cognitive processes underlying the task of interpreting. Process-oriented technologies are the distinctive element of computer-assisted or computer-aided interpreting (CAI), which can be defined as a form of oral translation, wherein a human interpreter makes use of computer software developed to support and facilitate some aspects of the interpreting task with the overall goal to increase quality and productivity. In this context, CAI tools are all sorts of computer programs specifically designed and developed to assist interpreters in at least one of the different sub-processes of interpreting, for instance knowledge acquisition and management, lexicographic memorisation and activation, etc.

The second group, the setting-oriented technologies, comprises ICT tools and software 'surrounding' the interpreting process proper, such as booth consoles, remote interpreting devices, training platforms, etc. They are setting-oriented as they primarily influence the external conditions in which interpreting is performed or learned, but can be considered somewhat marginal with respect to the main cognitive processes underlying interpreting. Setting-oriented technologies were central in the development of some interpreting

modes (one thinks of simultaneous interpreting, for example) and future developments, for example in the area of remote interpreting, may have a major impact on the interpreter profession, its status and the working conditions, but they will not radically change the core upon which the activity of interpreting is based.²

This classification is obviously an over-generalisation. Every technology could be placed in a continuous scale between these two extremes, depending on the perspective of the researcher and the way interpreters use them. So, for example, it is not easy to decide which of the two categories should be addressed by the Consecutive Pen³ (Orlando, 2014). The decision will clearly vary according to the fact that the Pen is used in the didactics of consecutive interpreting to capture simultaneously the video of the notes and the audio, in order for teachers to provide better advice to their students, or as a hybrid mode of interpreting (the so called Consec-simul with notes).

With further advances in both process and setting-oriented technologies and due to the fact that we are getting accustomed to using digital devices in almost all walks of life, it is plausible to expect that the influence of both groups of technologies on all aspects of interpreting – profession, didactics and research – will increase in the years to come. The focus of this chapter, however, is solely on process-oriented technologies, i.e. CAI tools, as this appears an under-represented subject within interpreting studies in general, and technology-related studies, in particular. The fact that interpreters increasingly rely on software, both interpreter-specific and not, to support their daily professional life (just think about the presence of laptops and tablets in the booth) makes new technology in interpreting an interesting research subject which requires to be analysed in detail. The rest of the chapter is structured as follows: Section 2 gives a brief overview of the major studies on information and communication technology. Section 3 introduces process-oriented technologies in

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- 2 To draw a parallel with the translation profession, process-oriented technologies (CAI tools) can be considered the interpreter's counterpart of computer-assisted translation (CAT) tools, both having an influence on the translation process and product, on the workflow, etc. Setting-oriented technologies are similar to translation process external technologies, like computers, e-mails and so forth, which have obviously revolutionised the way translators work, their status etc., but have only marginally changed the translation process and sub-processes (see for example Austerlühl, 2001).
 - 3 This technology refers to a digital pen used to take notes and to capture data on a special paper. It integrates a built-in microphone, a speaker and an infra-red camera. A program synchronises what is being recorded as handwriting with the audio recorded at the same moment. The user can tap on a word on the notebook to hear the part of the speech related to it.

more detail, distinguishing between first and second-generation CAI tools and presenting the features solutions available at the moment on the market offer. Section 4 presents the major challenges that interpreting studies need to address to bridge the emerging gap between the developing profession and the research activities in this discipline, arguing for more empirical research to understand the influence of CAI tools on the interpreting workflow and to guide the future development of new tools. Finally, the conclusions summarise the topics introduced in this chapter and present some future perspectives.

2 New Technologies and Interpreting Studies

In the past, the academic interest for the topic of ICT in the domain of interpreting has been very marginal and the number of studies published very small (Berber-Irabien (2010) points out that only 1.12% of titles included in the CIRIN Bulletin from 2003 to 2008 were technology-related). The situation is now slowly changing and the interest in new technologies has increased over the years. In the last CIRIN Bulletin (Gile, 2015b), for example, 7 items out of 64 were explicitly dedicated to some technological aspect of interpreting. The three main areas of interest are remote interpreting,⁴ especially telephone and video interpreting, computer-assisted interpreter training⁵ and computer-assisted interpreting software. A bibliometric analysis shows that the majority of studies conducted to date concentrate on the first two areas, while studies focussing on our object of interest, software designed to assist interpreters, play a secondary role.

The first publications dealing in some way with CAI tools can be dated back to the period around the turn of the millennium, but the subject has started to gain a significant momentum only during the last few years after the first interpreter-specific programs had entered the market. Some papers have pointed out how general, not dedicated, tools such as search engines, online glossaries and so forth have changed the way interpreters access and elaborate knowledge (Kalina, 2009, 395); others have analysed the terminological competence interpreters need and how it can be managed with the help of computer programs (cf. Rütten, 2007; Will, 2009); others have proposed and designed programs to help interpreters manage and access conference-related

4 For an overview see Tripepi Winteringham (2010) and Andres and Falk (2009).

5 For an overview see Carabelli (1997), Gran et al. (2002), Sandrelli and Jerez (2007) and Lim (2014).

terminology and information (cf. Fantinuoli, 2009; Stoll, 2009; Fantinuoli, 2012); some others, finally, have reviewed the tools available on the market (cf. Costa et al., 2014).

CAI tools are strictly related to terminology and knowledge acquisition and their integration in the interpreting process. Consequently, particular attention has been devoted to these topics. Rütten (2007) analysed the role of and relationship between information and knowledge from the point of view of conference interpreting. Extending the classical concepts of terminology and terminology management to the broader field of knowledge and information management, she describes knowledge as a combination of language, content and situational knowledge, pleading for a knowledge representation in the classical model of Wüster (Rütten, 2007: 83): concept, object and designation and their reciprocal relation. Rütten articulates the workflow of knowledge acquisition on the basis of Kalina's phases with dedicated 'learning' operations for each phase. Eventually, she identifies a progression during the course of preparation in the data-information-knowledge continuum (ibid: 113): from simple and sparse data to the establishment of a complex knowledge system.

In a case study, the author analyses the entire process of interpreting (from the assignment to the post-elaboration of information) under the perspective of information and knowledge processing. Based on her observations, she speculates on the manner in which a computer program could be integrated in the interpreting's workflow. She proposes a software model that should support the interpreter during the entire interpreting process. It consists of three components:

- a language-oriented terminology module
- a content-oriented documentary module
- a situation-oriented overview module

As Rütten (2007) points out, the software's single components are not to be seen as completely independent from each other, as terminology data always contains extra-linguistic information, documents are also a source for terminology, etc. The idea of developing a tool for all interpreting phases, which integrates both linguistic as well as non-linguistic information, laid the foundations for extending the scope of first-generation CAI tools, which, as pointed out in Section 1, were only focussed on the management of multilingual lists of word equivalences.

Another aspect very much debated academically is the lexical and conceptual gap between interpreters and event participants, especially when working on specialised subjects (Morelli and Errico, 2007). This depends on the fact

that interpreters generally do not share the same level of specialised expertise as the conference participants (cf. Will, 2009; Fantinuoli, 2011; Fantinuoli, 2016a; Fantinuoli, 2016b); to fill this gap, interpreters do preparatory work prior to the beginning of the interpreting task. When preparing for an assignment, they typically use the reference material at their disposal to gain as much information on the subject as possible. A central point of this preparatory work is the collection and management of terminological information. It is evident, as pointed out by many scholars (cf. Morelli and Errico, 2007), that terminology plays a central role in any language mediated activity, as ontologies and term collections are required to create the knowledge system needed to achieve a precise and shared comprehension.

According to generally accepted terminological standards, the collected information should be organised in a complex terminological repository, as introduced in Arntz et al. (2009). Yet, interpreters' glossaries are generally a context-free list of terms and their translations (Will, 2009). They are concise, compiled according to personal needs and contain also very infrequent terms. This praxis poses several problems: on the one hand, simple word equivalences in two or more languages do not allow a clear term disambiguation. On the other hand, compiling glossaries – even if they are reduced to mere terms and their possible equivalence – is a time-consuming task. In fact, it is not possible to know exactly beforehand, i.e. before the end of the event, what will really be needed during the interpreting task (for example infrequent terms). The obvious tendency is to invest a lot of time processing terminological information that will never be used in the course of interpretation. As a consequence, interpreters need to anticipate topics and settings of the assignment, resolving beforehand the possible problems that may arise during the interpreting task. This calls for a very effective and specific way to constitute the relevant terminological and encyclopaedic knowledge.

In that regard, Will (2009) describes the complexity of the knowledge systems that must be mastered by interpreters in order to perform an interpretation of excellent quality and proposes an interpreting-oriented terminology approach, the so called DOT.⁶ He applies the context-related term model of Gerzymisch-Arbogast (1996), which considers possible deviations from the unique correlation between concept and designation, as defined by Wüster (1991). According to this principle, since terminology is embedded in texts, it can be 'contaminated' by the knowledge system itself. According to Will, these potential deviations of the meaning are not taken into consideration in

6 DOT is the abbreviation of the German 'Dolmetschorientierte Terminologearbeit' (Interpreter-oriented terminology work).

context-independent word lists (simple glossaries), and this may lead to incorrect translations, for example in case of polysemy or terminologisations (Will, 2009: 6). In order to solve this problem, Will pleads for what he defines as 'detective work', an approach to terminological work which allows interpreters to represent terms in context: from the term and the term definition to the specific knowledge system. This relationship can be constituted by comparing an individual term structure to its systematic reference meaning. The result consists of Terminological Knowledge Entity (TKE), the 'smallest complete knowledge unit for understanding and producing technical texts' (Will, 2007: 69). Grouping together the individual entities established in TKEs, it is possible to constitute complex structures which are the basis of text comprehension and production. If such mental structures of knowledge are dynamic, they may allow interpreters to give meaning to what they hear, for example, through principles such as deduction, inference and anticipation (Morelli & Errico, 2007).⁷ In most general terms, preparation must allow interpreters to gain a systematic overview of the knowledge systems and the terminologies involved in the event as well as their ranking in terms of importance and priority. The knowledge systems that emerge can ultimately be recorded in a glossary and used during interpretation.

As far as CAI tools are concerned, many authors point out how they could offer a practical support to better rationalise and organise the process of knowledge constitution and its use before and during the task of interpreting (cf. Will 2009; Rütten 2007; Stoll 2009; Tripepi Winteringham 2010). Even if the interest among practitioners, especially among the new generation, and some scholars seems to have increased during the last years, the overall impression is that the applied use of CAI tools has remained marginal in the growing body of interpreting studies, as confirmed by the small number and scope of publications dedicated to the topic. This is particularly true for experimental studies.

In the context of specific tools dedicated to preparation, Xu (2015) experimentally investigated how a corpus-based terminology preparation, which integrates the building of small comparable corpora as well as the use of automatic term extractors and concordance tools, can improve trainee interpreters' performances. The results show that the test groups consistently had better

7 For example, Chernov (2004) viewed prediction or the so-called expectation-based processing as being fundamental to the interpreting process. He distinguishes between message elements that are new and those that are already known (thema-rhema progression) and argues that the attention of interpreters is on the new components of the message which are processed on the basis of probability prediction based on available knowledge. This knowledge-driven processing is common to many interpreting models.

terminology performance during simultaneous interpreting: they interpreted more terms correctly, had higher terminology accuracy scores and made less term omissions. Furthermore, they also had higher holistic simultaneous interpreting performance scores than the control groups. These results suggest that the Corpus Driven Interpreters Preparation (CDIP) (Fantinuoli, 2006; Gorjanc, 2009) can help interpreters improve their performance when working on specialised topics. In order to implement CDIP, Fantinuoli (forthcoming) proposes a corpus-based CAI tool specifically developed to support interpreters during the preparatory phase. In the same context, two studies have also focused on automatic corpus construction and terminology extraction: Fantinuoli (2006) proposed an automatic terminology extraction in order to provide interpreters with a preliminary list of highly specialised monolingual terms for the conference preparation while Xu and Sharoff (2014) evaluated and assessed the amenability for interpreters of several term extraction methods. Even if the accuracy of the extraction methods is not perfect, both studies stated that the use of small specialised corpora and automatic terminology extraction may facilitate interpreters in their preparation.

The only papers focussing on the implementation of real CAI tools are dedicated to the projects InterpretBank (Fantinuoli, 2009, 2011, 2012, 2016b), Lookup (Stoll, 2009) and CorpusMode (Fantinuoli, 2016a). In these studies, the authors describe the development and features of the three CAI tools, discussing the theoretical framework for the implemented solutions: the actual requirements in terms of linguistic and extra-linguistic knowledge needed by professional interpreters and how they can be constituted are analysed; a general structure of the interpreters' workstation is presented on the basis of advances in terminology management and information retrieval approaches; finally, the components of the workstation are implemented.

More recently, first attempts at empirically analysing CAI tools, both in the context of interpreting quality as well as in the didactics, has been made. Gacek (2015), for example, tried to answer the question whether the use of terminology tools in the booth improves the interpreter's performance in terms of terminological quality. Based on the experimental data and comments obtained, the study shows that the use of interpreter-specific terminology software⁸ during the interpreting task is more efficient in improving the terminology rendition (correctness and completeness) than other solutions (paper glossaries). Even if the study is interesting as it empirically suggests that the negative attitude of some practitioners, claiming for example that such tools, at least in the booth, are somewhat unnatural (Tripepi Winteringham, 2010), is unfounded, it lacks

8 The tool used in the experiment was InterpretBank.

of a robust experimental setup (the testers were unexperienced in the use of the tool, the text was manipulated in order to have a small set of terminological stimuli which did not allow for other translation strategies to be applied, etc.) and statistical analysis. To overcome these shortcomings, more controlled tests with different settings (tester, stimuli, etc.) and advanced statistical measures are needed. With this in mind, Biagini (2016) compared the performance of interpreters dealing with a specialised text characterised by a high terminological density, both with a CAI tool⁹ as with a paper glossary and developed a rigorous experimental setting in order to control the independent variables at stake (the testers were selected according to stringent criteria, i.e. they had gone through the same amount of practice with the tool, were provided with the same glossary etc.) and used statistical tests to guard for the reliability of the data. The analysis of the results shows that under certain conditions CAI tools improve the overall interpretation quality in terms of terminology accuracy and completeness of the interpreted text.

Another almost unexplored area has to do with the didactics of CAI tools. As some universities recognised the need to adapt their curricula to the emerging use of new technologies in interpreting, a pilot study was conducted at the University of Bologna to understand how to integrate CAI tools in the curriculum (Prandi, 2016). The aim of the experimental study was to collect information on the students' approach to such tools¹⁰ in the booth. The analysis of audio/video as well as keylogging data shows that experience plays a key role in helping user integrate the tool in their workflow and that most testers were able to conduct effective terminology searches (with an average 90% rate of terms correctly identified). As a drawback, the author stressed the tendency of some testers to rely too much on the software, with obvious negative consequences on the overall performance. The result of this first study seems to indicate that CAI tools can be successfully integrated in the curricula of future interpreters, provided they already have robust experience in interpreting (for example at the level preceding the final exams, as the texts need to be of a rather specialised nature) and enough time to understand how to adapt their interpreting strategies to the use of the tool. Similar conclusions were drawn by Biagini (2016) who correlated the empirical findings of his experiment with the responses provided by the participants in a questionnaire.

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3 Process-oriented CAI Tools: An Overview

As pointed out above, all language-related professions have been influenced by computer applications over the years. Differently from translation and technical writing, where a plethora of software has been developed to assist humans during their work, the software targeting interpreters remains very limited in number and scope. They have become more popular in recent years, but their impact on the profession has so far been marginal. There are several interdependent reasons for this:

- many professional interpreters have been generally reluctant to accept the idea of software supporting them during the interpreting process, maybe because this could possibly raise doubts about the pure intellectual activity of interpreting;
- many practitioners consider the use of CAI tools in the booth as unnatural, the reason being that it is a time-consuming and distracting activity (cf. Tripepi Winteringham, 2010, 4).
- the cognitive processes of interpreting, especially simultaneous interpreting, have not been completely ascertained (cf. Will, 2009, 19), making it quite difficult to design software able to smoothly integrate with the interpreting process;
- too little effort has been invested in systematically investigating the role of terminology and knowledge acquisition in the interpreting process and, most importantly, the role of software tools in the interpreting process;
- from an economic point of view, interpreting plays a marginal role in the language industry. Consequently software houses committed to the development of tools for language professionals have never invested time and money in the design and implementation of software for interpreters;
- differently to the translation industry, where CAT tools are recognised as a cost cutting factor, the economic gain in using dedicated software is not clearly measurable;
- universities offering courses in conference interpreting do not usually, or only marginally, introduce novice interpreters to the topic of computer-aided interpreting.

Notwithstanding the above-mentioned reasons, a small number of pieces of software have been developed during the last 15 years or so. Differently to CAT tools, which are nowadays very similar in terms of design and functionalities, dedicated tools for interpreters are quite heterogeneous. This can be mainly

related to two reasons. Firstly, CAI tools are relatively new and less widespread; this has deprived them of many test and improvement phases, which are crucial to achieve software maturity and find the golden standard in terms of functionalities desired by the professional group. Secondly, no major investigation has been attempted by scholars to understand the type of software and functionalities required by interpreters in order to optimise their performances. In fact, as interpreting is still considered a rather individual task, tool design nowadays reflects more the ideas and habits of the respective developer, generally an interpreter himself, than the needs of the interpreter community.

CAI tools can be distinguished according to several criteria, for example the workflow phases covered or the presence of a simultaneous modality, which takes account of the time constraints of simultaneous interpreting, as this is a crucial element of the profession. If it is going to be used in the booth, the terminology-lookup mechanisms needs to behave quite differently from that implemented in translation-oriented terminology tools. In order to reduce the cognitive load needed to look up a term, CAI tools may in fact use algorithms designed to reduce the number of strokes needed to input the search word, to correct typing errors, to discriminate results according to the conference topics, their relevance, etc.

Depending on their architecture and functionality spectrum, CAI tools can be broadly divided into two groups: *first-generation* CAI tools, proposed for the first time about 15 years ago and, more recently, *second-generation* CAI tools. First-generation tools are programs designed to manage terminology in an interpreter-friendly manner. Being very simple in terms of architectural design and functionalities, they support interpreters in managing multilingual glossaries similar to MS Word or Excel lists, but do not envisage any other specific supporting activity of the interpreting process (such as information retrieval). The list of first-generation software is comprised of Interplex,¹¹ Terminus,¹² Interpreters' Help,¹³ LookUp and DoTerm. Only Interplex, Terminus and Interpreters' Help are still maintained and are commercially available. Designed to manage multilingual glossaries, they are basically graphic interfaces to store and retrieve terminological data from a database. They are different from terminology management systems for terminologists and translators as they use simple entry structures and offer basic functionalities to look up glossaries in the booth. All tools can store additional information to the terms in explicitly or implicitly dedicated fields and allow the categorization of entries through

¹¹ www.fourwillows.com/interplex.html.

¹² www.wintringham.ch/cgi/ayawp.pl?T=terminus.

¹³ www.interpretershelp.com.

a one-tier categorisation system (Interplex, Interpreters' Help) or a multi-tier system (Terminus, LookUp and DolTerm). In order to search the database, the user enters a string of text (the term or part of it) in the search mask and presses the enter key. None of the first-generation tools implement any sort of advanced search algorithm to take account of the time constraints of the interpreting task, such as misspelling correction, progressive search in one or more glossaries, etc. As a simple and user-friendly solution to store and access the terminology in the booth during interpretation, first-generation CAI tools can be treated as a simplified version of traditional terminology management systems (such as Multiterm) with an easy-to-use search functionality. If such tools can undoubtedly be considered a first step towards the optimisation of some aspects of the interpreting task (for example, making the use of paper glossaries in the booth superfluous and making it easier to reuse previously compiled glossaries), they are far from becoming a complete interpreter's workstation which is able to take into account the other aspects of the interpreting process, as indicated by the literature summarised in Section 2.

With the goal of extending the limited scope of first-generation CAI software, *second-generation* tools build on first academic research and investigations on terminology and knowledge management. They present a holistic approach to terminology and knowledge for interpreting tasks and offer advanced functionalities that go beyond basic terminology management, such as features to organise textual material, retrieve information from corpora or other resources (both online and offline), learn conceptualised domains, etc. The second-generation tools developed to date are InterpretBank¹⁴ and Intragloss.¹⁵ They exploit more advanced computational approaches to offer professional interpreters a supporting toolset suitable for different phases of the interpreting process, from preparation to interpretation in the booth. InterpretBank is a prototype developed between 2008 and 2012 as part of a doctoral research project at the University of Mainz/Germersheim (Fantinuoli, 2009, 2012, 2016b). The modular structure of the tool aims at covering the different phases of the interpreting task, as defined by Kalina (2007). For the preparatory phase, for example, it comprises automatic translation and terminological retrieval from online resources, which helps to speed up the glossary creation procedure, the integration of the preparatory material handed out by the conference organiser, a concordancer to look up terms in real context (in sentences extracted from the conference material), a memorisation utility to learn the glossary prior to the conference and so forth. Intragloss focuses

14 www.interpretbank.com.

15 www.intragloss.com.

on the preparatory phase of an assignment and presents a novel approach to glossary building, as it is based on the interaction between preparatory texts and the terminological database. On one hand, it allows filling a glossary by highlighting a term in the preparatory document and searching for its translation in online resources such as glossaries, databases, dictionaries, etc. On the other, it automatically extracts all the terms from the domain glossary that appear in the preparatory documents, thus directly linking the texts with the available terminology repository.

If classified according to the presence of the simultaneous modality, the only tool which implements a solution for looking up terms in the booth, taking into consideration the time-constraints and peculiarities of the simultaneous modality, is InterpretBank. The tool uses a dedicated utility to increase its usability in the booth by reducing and focussing the mass of information at the interpreter's disposal. The conference modality seeks to diminish the cognitive load needed to query the database by means of *fuzzy search*, which acts as an error correction mechanism for misspelling in the word typed by the interpreter or present in the glossary, *stopwords exclusion* for reducing the number of matches displayed as a query result, *dynamic search* in the glossary to avoid the use of the enter button, *progressive search* in a hierarchical structure of glossaries according to their relevance for the actual conference and so forth.

4 Investigating CAI Tools: The Challenges That Lie Ahead

Computer-assisted interpreting is slowly changing the interpreting landscape and the statements of some scholars are very clear with regards to the potentiality of CAI tools:

It may be thus assumed that, in the practice of the profession, interpreting rendition may benefit from the use of technological aids. CAI may indeed be a major breakthrough in the interpreting field as it may provide a powerful solution enabling interpreters to improve both the quality and productivity of their interpretation services.

Tripepi Winteringham, 2010: 3

However, quality and productivity shifts related to the introduction of CAI tools in the interpreting workflow have not been the object of scientific investigation so far, as pointed out in Section 2. Research, especially with empirical and quantitative methods, is therefore urgently needed. Its goal should be to analyse the positive and negative influence of CAI tools in the interpreter's

performance and their role in the cognitive processes underlying the interpreting task. The questions that should be addressed, among others are: as typing an unknown word on a keyboard requires an additional time-consuming effort, how would this affect the efforts balance of interpreting? Could the activity of searching for a term result in distraction and loss of concentration for the interpreter? For what kind of texts should interpreters access terminology in real-time?

First empirical tests have been conducted at some universities (see Section 2), but a lot of preliminary work is still required, primarily with respect to the 'methodology' to be adopted in the experimental setting. This is somewhat crucial if one considers the high number of variables at stake in the interpreting process and, consequently, in the design of experiments (interpreter's experience, personal attitude towards CAI tools, text typology, to name but a few). The fact that we still need to understand what kind of experimental designs are bound to give the best fruits is not surprising if one considers that this is uncharted territory in which new theories still need to be developed. The real challenge, however, concerns the finding of proper ways to operationalise the research questions. Once the scientific hypothesis has been formulated, how should the interpreted texts (possibly a corpus of interpreted texts) be investigated in order to identify concrete manifestations of the use of CAI tools? What sort of things do we need to search for and what sort of techniques do we apply to locate them? How can we triangulate results in order to account for all variables involved in the experimental setup?

In analogy to descriptive translation studies (cf. Toury, 1995), both product-oriented and process-oriented research could help us to formulate tentative answers to the above mentioned questions. In this context, under product-oriented research we understand the quantitative and qualitative analysis of interpreted texts produced by interpreters with the support of some sort of CAI tool. Product-oriented studies are generally of a comparative nature, as they tend to investigate both the source and target texts by means, for examples, of contrastive linguistics, contrastive pragma-linguistics, contrastive pragmatics and contrastive discourse analysis (cf. Vandepitte, 2008) or texts produced under different conditions (with, without or with different CAI tool). From a methodological point of view, such studies could profit from a corpus-based approach, for example when comparing interpreted texts with a corpus of comparable, non-interpreted texts, as is now common practice in studies of translation universals and the like (Baker, 1995). Product-oriented research could be employed to measure if and how the use of CAI tools influences the interpreter's performance and to discover if their use left some sort of 'fingerprint' (Gellerstam, 1986) in the interpreted texts. Even if quality criteria in

interpreting are not easy to define and may diverge greatly depending on the perspective adopted and the conference context,¹⁶ experimental tests, comparing for example the interpreters performance with and without tools, could be the basis for inferencing the influence of tools on the overall performance of interpreters from a set of predetermined findings and observations.

As most CAI tools are strictly related to the lexical level of interpreting and, not-surprisingly, terminology is considered crucial in meetings of technical nature (cf. AIIC, 1995), product-oriented studies could help to analyse the terminological rendition of interpreters working with or without CAI tools in the booth. We may look at terminology accurateness as an indication of successful use of CAI tools for terminology access tasks. Given the fact that functional communication could also be achieved without the use of a specific terminological unit, but applying other translation strategies or tactics (for example paraphrasing, using a hyponym, etc.), the terminological rendition should be evaluated in correlation with other parameters of the interpreted text, such as completeness, fluidity, semantic or functional correspondence and all related strategies applied (removing redundancies, anticipation through discourse inference, compression, etc.). Similar empirical tests could be used to investigate different aspects of the use of CAI tools in different phases of the interpreting assignment. Not only the more obvious terminological lookup in the booth, as mentioned above, should be in focus, but also the use of special tools during the preparation, for example in the constitution of the knowledge background, the lexicographical memorisation and so forth. Are differences measurable in terms of invested time and quality output?

On the other hand, process-oriented research in interpreting studies, encompassing foremost cognitive aspects and methods, could shed light on the brain of interpreters, as seen in the described product-oriented research. For example, what happens when conference interpreters are simultaneously exposed to sensory information on different input channels? As suggested by Seeber (2012), a multimodal setting is not limited to the realm of remote interpreting, but it applies to most ordinary conference interpreting scenarios nowadays. Computer-assisted interpreting is by definition a multimodal scenario, as it adds to the traditional stimuli the parameter of the use of a CAI tool (which could also be broken up in several parts, such as keyboard use, search of the right information on screen, read of relevant information, etc.). Is it possible to reduce the cognitive load during interpreting to allow for terminology lookup activities? If yes, which strategies could be applied in order to smoothly

16 Not to mention that the quality of an interpretation is never inherent in the interpretation itself but attributed to it by some instance (cf. Zwischenberger, 2010).

incorporate the results of a terminological query in speech? Process-oriented research could help to understand the effects of CAI tools on the interpreting task (the process), an area, where very little progress has been made during the last years. However, new methods (eye-tracking, Electroencephalography (EEG), etc.) should be explored for process-based research and, if successful, attempts should be made to use them systematically in experimental tests (cf. Seeber, 2013). Besides helping to describe the characteristics of computer-assisted interpreting, both product and process-oriented research could allow us to better define what a tool specifically designed for interpreters should offer and how it should be integrated in the interpreting process.

As introduced in Section 3, first and second generation CAI tools are more or less based on the personal ideas of their developers, mostly interpreters themselves, and lack any experimental support in their design decisions. Particular attention should therefore be devoted to the way knowledge in general, and in particular lexicological knowledge, should be structured and presented to the user in order to cope with the limits proposed in literature. The question of information visualisation is very much debated in cognate disciplines, as it should be in interpreting. The analysis of the limits of available software coupled with a better insight into the cognitive processes of interpreting could allow the scientific community to propose CAI tools that move from the representation of simple linguistic equivalences (the typical structure of interpreter glossaries) to a new, interpreter-friendly way to represent a specific domain and its terminology.

Finally, another important topic that should be addressed concerns the didactics of interpreting. If CAI tools (as all other interpreted-related technologies) are slowly redefining the professional landscape, there is no reason why advantages and shortcomings of their use should not be properly addressed in the training of future interpreters. At the moment, the number of universities actively engaged in teaching new technologies in interpreting courses is very limited,¹⁷ while much of the work is done outside the regular programs in the form of seminars and workshops offered, for example, by professional associations. If we want future generations of interpreters to be prepared to address technological changes, the topic should be recognised as an important part of the didactic objectives of any educational institution. Consequently, a debate on when and how the topic should be taught needs to be initiated.

17 In 2014, the University of Innsbruck introduced a curricular course dedicated to Technologies for interpreters in their Master of Conference Interpretation and the University of Surrey is much devoted to the teaching of remote and mobile interpreting.

5 Conclusions and Future Research

New technologies are slowly reshaping the landscape of professional interpreting and there is reason to believe that the pace of change will increase during the next years. The challenge for interpreting scholars is to research the use of evolving CAI tools, assess their feasibility, analyse the strategies interpreters may need to adopt and, eventually, transfer this knowledge to the training of a new generation of interpreters.

The emerging role of both process and setting-oriented technologies has started to be recognised by researchers and first studies on the subject have been published recently. Yet, the majority of studies is of a general or theoretical nature, while the number of empirical studies is still almost insignificant. However, in order to shed light onto the advantages and disadvantages of CAI tools, the way they are affecting the interpreting process and the tasks interpreters can perform better with their help and those which cannot, research on new technologies needs to be performed not only on the basis of naturalistic methods (such as corpus analysis), but empirical experiments should be conducted also in stringently controlled experimental conditions.

Both process and product-oriented research in this area are required. There are obvious difficulties that still need to be addressed: experimental design must be optimised and robust experimental methods must be imported into empirical interpreting research,¹⁸ as it is the case with written translation process research. In order to understand how to operationalise the research hypothesis, much of exploratory research is still required, and modern experimental techniques such as eye-tracking, EEG, etc., should be tested and applied if proven successful.

ICT is advancing quickly and is opening new perspectives in the area of CAI tools. Speech recognition, for example, could represent the next step in the

18 This point of view, however, has been very much criticised by many researchers and practitioners, their main concern being the ecological validity of the tasks and environmental conditions under which they have been called to interpret (cf. Gile, 2015a: 54). Even if interpreting is generally viewed as a strategic activity (a fact that should make it difficult to conduct research in the same way as in cognate disciplines, for example psychology), the careful design of experimental settings and the proper control of all variables at stake is a prerequisite for obtaining reliable data. With all due respect to the concerns expressed by many scholars, this will mean, for example, that source texts should not be selected only according to the fact that they are 'real' (i.e. typical for the profession), but they should be selected, and manipulated, in order to provide controlled material for the analysis of the dependent variables at syntactical, lexical or semantic level.

evolution of CAI tools. It could be used to automatically extract terminology in real-time from the interpreter's database or to show name entities, numbers and the like on the interpreter's monitor. Would this influence the interpreting process? Would it facilitate the interpreting task or determine a cognitive overload? Again, to find an answer to these and other questions, empirical interpreting studies are required. This seems the only way for interpreting studies to keep pace with an evolving profession.

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