Computer Aided Interpreting (CAI) for Conference Interpreters. Concepts, Content and Prospects

Doctor Martin WILL
AITReN – Advanced International Translation Research Network
GERMANY
drmartinwill@aol.com

Abstract: While specific and relatively uniform software is used in translation throughout the industry, only a minority of interpreters today uses dedicated software for their assignments and even less during the creation of the final product, the interpretation. This is even more surprising as there are already solutions available today that make it possible to considerably automate an interpreting assignment. It is argued that many interpreters refuse to use computers for interpreting or have little idea of the possibilities of Computer Aided Interpreting (CAI) but there is also a certain confusion in literature as regards the usage of the term "CAI". Therefore, in the following, an overview of major developments in this field and a comparison with translation will be given in order to derive a differentiated definition of the term "Computer Aided Interpreting". Subsequently, a model workflow will be used to demonstrate existing computer based applications that allow already now to considerably automate a complete interpreting assignment. In a further step, these products will be critically evaluated. Finally, an outlook on future developments and trends in the field of CAI will be given. The aim of this contribution is to give a coherent overview of CAI and thus contribute to its better understanding.

Keywords: Computer Aided Interpreting (CAI), interpreter-oriented terminology work, phase model of interpreting, knowledge management in simultaneous interpreting

***

Interprétation Assistée par l'Ordinateur (IAO) pour les interprètes de conférence. Concepts, contenu et perspectives

Résumé: Des logiciels spécifiques et relativement uniformes sont utilisés dans l'ensemble du secteur de la traduction, alors que seulement une minorité d'interprètes utilisent actuellement des applications dédiées pour leur travail et moins encore pour la création du produit final, l'interprétation. Cela est surprenant, d'autant plus que des solutions permettant d'automatiser considérablement le processus de l'interprétation existent déjà. Il semble que de nombreux interprètes

 © ESSACHESS

refusent d'utiliser des ordinateurs pour l'interprétation ou en savent très peu sur le potentiel de l'IAO. Il faut également noter une certaine confusion dans la littérature scientifique quant à l'utilisation du terme « IAO ». Un aperçu des principaux développements dans ce domaine ainsi qu'une comparaison avec la traduction permettront de dégager une définition différenciée du terme « interprétation assistée par ordinateur ». Après quoi le recours à un modèle du flux des tâches rendra possible une démonstration des logiciels existants pour une automatisation considérable de l'ensemble des tâches du processus de l'interprétation. Ces programmes seront ensuite soumis à une évaluation critique. Enfin, les perspectives de développement et les tendances futures dans le domaine de l'IAO seront évoquées. L'objectif du présent article consiste à donner une vue d'ensemble cohérente de l'IAO et de participer ainsi à sa meilleure compréhension.

Mots-clés: Interprétation Assistée par l'Ordinateur (IAO), travail terminologique pour interprètes, modèle des phases de l'interprétation, gestion du savoir dans l'interprétation simultanée

***

Introduction

Translating and interpreting essentially differ in that in translating, a fixed source text is converted into a target text that is also fixed in writing and can be modified at will over a longer period. Interpreting, on the other hand, consists in transforming a usually spontaneously produced oral discourse in another oral text in the target language. This happens either ad hoc and simultaneously or in the same time span as the original, the final product being in all cases practically unmodifiable. From a more general point of view, however, translating and interpreting are two closely related activities, which basically consist in adequately transferring information from a source language text into information in a target language text.

One might therefore think that the typical tools used by translators and interpreters are relatively similar or at least comparably widespread. However, surveys for both usage groups continuously show that this is not the case, especially with regard to the use of modern, computer-based technologies: While tools for Computer Aided Translation (CAT) are consistently and uniformly used throughout the industry (cf. amongst others Tabor, 2013), only a minority of interpreters rely on comparable tools for interpreting and even less when it comes to the generation of the final product, the actual interpretation (cf. amongst others Corpas & Fern, 2016).

This is the onset of the present contribution. It starts by attempting to provide an explanation for the digital divide between translation and interpreting which it sees as a consequence of a different evolution of CAT and CAI over time and a lesser socio-economic importance of interpreting as a niche market (section 1 and 2). The ensuing imbalance seems to be aggravated by a certain lack of information and unclear attitudes towards the usage of the computer amongst a majority of interpreters and even in literature (section 3). On the basis of a differentiated

definition of the terms "CAI"/"CAI tool" /"CAI system" (section 4), a model for the description of an entire interpreting assignment and the ensuing workflow are briefly introduced (section 5 and 6). In chapter 7, existing CAI tools are presented in relation to specific steps of the workflow described. Section 8 critically evaluates the results and makes some recommendations. Section 9 gives an outlook on possible future developments followed by a conclusion in section 10.

The aim of this contribution is to give a coherent overview of CAI and its possible practical integration into the human workflow in order to contribute to a better understanding and wider usage of the phenomenon.

1. CAT: Origins and Evolution

Garcia (2014, p. 69) uses the term CAT (Computer Aided Translating) "[...] to designate the suites of tools that translators will commonly encounter in modern workflows". This includes (op. cit.: 68ff): "[...] software applications created with the specific purpose of facilitating the speed and consistency of human translators, thus reducing the overall costs of translation projects while maintaining the earnings of the contracted translators and an acceptable level of quality".

According to Garcia, these industry-specific applications consist of so-called "core functionalities" (automatic translation memories and automated terminology insertion from freely configurable terminological databases) which provide parts of the final product. They also offer "additional functions" to support individual aspects of the overall workflow (term extraction, quality assurance, formatting etc. – op. cit., p. 69).

CAT systems developed in the early 1990s. They emerged as a consequence of the PC revolution and the development of the Internet. The resulting localization demand led to an exponential increase in the demand for translation services within a very short period of time (Garcia 2014, p. 68). These services could only be provided by an increasing number of freelance translators, especially since, in the course of the transition to the service society, the large in-house translation services such as those at *IBM* were systematically closed down.

This sudden demand went hand in hand with the need to make the translation process more efficient and uniform and to organize it. This explains why translation agencies such as *Trados* or individual translators like Emilio Benito, the founder of *Déjà Vu*, became the first developers of commercial CAT applications[1].

While the acceptance among translators was initially low and CAT tool originally considered as mere "terminology management systems" (Garcia 2014, p. 69), this changed at the beginning of the new millennium. Thanks to a call for

[1] *Trados* published its first product *Translator's Workbench* in 1992 and *Déjà Vu* its eponymous software in 1993. Both companies are still active today.

tenders by the European Commission, *Trados* established itself as the industry standard, and the use of CAT software became not only a prerequisite for the award of contracts, but also stood for a higher level of professionalism (Garcia 2014, p. 70, 77).

This went hand in hand with a rapid industrial and scientific development around internationally positioned companies (e.g. *SDL plc*, *Across Systems GmbH*, *MemoQ*). Regular adaptation to technical and scientific progress included linguistic functions (corpus managers, automatic terminology extraction, concordance analysis), browser-based interfaces, the integration of Machine Translation (MT) and cloud computing. As a result, the software controlled more and more tasks and the role of the human translator increasingly shifted to validating machine decisions.

Despite this dynamic development and the ever-increasing number of CAT tools[2], the different applications remained compatible with each other. Thus, the *TMX* format enabled the exchange of translation memories across different applications. Since 2002, an internationally standardized file format (*XLIFF*), is also available for the exchange of project data among different CAT products.

More generally, the situation of CAT tools can be summarized as follows:

- The number of available products is high. Surveys and statistics show that they are widely used and accepted by translators[3], especially as they are often a prerequisite for the award of contracts.

- Despite a difference in certain supporting functions and modules, the products are compatible with each other and usually share a common file format.

- Most applications are professionally developed and commercialized, often by larger companies with a long-standing market presence.

2. CAI: Origins and Evolution

As CAT, CAI has its origins in the 1990s. Consequently, both technologies share the same historical background, but differ greatly in terms of their development within the respective industries. While translating experienced a strong expansion for the reasons already mentioned, the interpreting market developed much more slowly. This was particularly true for its main component, conference interpreting, with its traditionally high logistical and technical requirements and the associated costs.

---

[2] ProZ.com (2019) cites currently 30 different CAT tools.

[3] In a worldwide survey amongst 3000 translators, Tabor (2013) states that 88% of the participants used CAT tools. According to a detailed statistical survey amongst 588 professional translators in the UK, European Commission (2017, p. 27) finds that 65% used CAT tools. Verplaetse and Lambrecht (2019, p. 10) cite 6 studies that took place between 2006-2018, indicating usage ratios between 74% and 90, 8%.

These factors also help to explain the insignificant number of professional conference interpreters and contracts to be awarded compared to translation.

As a result, there was a lack of a wider socio-economic or institutional interest in the development of industry-specific software, which still has an impact today.

The beginnings of CAI lie in simultaneous interpreting. They aimed at replacing the paper-based glossaries that were common there. These simple "vocabulary lists" contained mainly microdata (simple denomination equivalences organized in language fields) extracted from the underlying conference documentation[4]. They were usually prepared anew for each assignment and were difficult to expand and search (especially during the interpretation). In contrast to translating, the use of the computer was hence not to increase the translation speed (which in the case of simultaneous interpreting depends on the original anyway), but twofold: On the one hand side, it was intended to make the preparation of an assignment more efficient (by adopting external or expanding own terminological data). The second goal was to improve the quality of the final product (by letting the PC query the underlying glossaries during interpretation). This orientation of CAI towards the so-called terminology work is still central today.

Due to the special textual conditions in interpreting (cf. section 5.2), neither the available CAT tools at that time nor common office software such as *MS Word* or *Excel* were suitable for this kind of application (cf. Will, 2000, p. 133; Sand in Stoll, 2009, p. 191); independent solutions were required. This led to terminology systems for simultaneous interpreting ("terminologiefähige Simultansysteme" – cf. Stoll 2009), which had to be adapted to the specific workflow or "phases"[5] of an interpreting assignment.

If one looks at the development of the individual applications from the very beginning, three development stages can be identified:

The beginning was made by simple glossary management programs in tabular form. They were organized in vertical language columns, containing denominations linked to a glossary name as only meta data. In addition to a print option and a function for importing and exporting glossaries, these applications were designed to be easy to use and to quickly retrieve denomination equivalences during the interpreting phase. A number of adjustable semi-automatic search, sorting and filtering techniques were available for this purpose. During the interpreting phase, a source-language character string was manually entered into a search field,

---

[4] Macro data (such as definitions and the corresponding affiliation to a knowledge system) and administrative metadata (such as date, entry number or affiliation to a domain or client specific assignment) were almost totally absent, probably because they were deemed to be too cumbersome to insert and to use on a paper format. For a systematic description of relevant data categories within the interpreting-oriented terminology work see Will, 2008, 2009 and 2015. For the problems associated with this kind of rudimentary terminology work see section 5 of this contribution and Will, 2015, p. 183-184.

[5] As regards the central concept of "phases", see section 5.

whereupon (if available) corresponding results were displayed in real time with the corresponding target-language entries as a hit list.

The first of these *first generation tools* (Fantinuoli, 2016, p. 44) appeared relatively early and were, as within CAT, modifications of existing office software, both relational databases under *MS* Windows: *Interplex* (fourwillows.com; Win/Mac/IOS; fee-based) by Peter Sand (1993)[6], which ran on *Borland Paradox*, and *DolTerm* by Christoph Stoll (no longer available today; it used *MS Access* as runtime environment).

Over the years, other similarly structured applications appeared, such as *TermdB* (not available anymore), *Terminus* (www.wintringham.ch; Win; fee-based) or *Glossar Manager* (www.glossarmanager.de; Win; freeware). Despite their rather modest possibilities and low adaptability (cf. Will, 2015), such applications still account for the lion's share of all interpreting-specific CAI tools[7].

From the turn of the millennium onwards, the focus shifted increasingly to automatize functions outside the interpreting phase, initially to reduce the manual input of terminological entries during conference preparation. Christoph Stoll was once again a pioneer in this area. In 2001, as part of his doctoral thesis, he not only presented a detailed, micro-, macro- and metadata oriented terminology entry model using *LookUp Pro* (no longer available today; it was also based on *MS Access*), but also proposed a semi-automatic filling function for his database directly from *MS Word* documents.

Interpretbank (www.interpretbank.com; Win/Mac/IOS/Android; fee-based), by Claudio Fantinuoli, which originated in 2009 as part of his dissertation project, pushed the development of this *second generation* of CAI tools decisively further. Based on the phase model according to Will (Prandi, 2014, p. 22), he developed a CAI tool with vast automation possibilities within the entire workflow of an interpreting assignment. *Interpretbank* included a "corpus mode" for the phase of conference preparation which automatically collected denominations with contextual information from the Internet and assigned them to a reduced entry model, containing some macro data as well as administrative metadata (definition, glossary name and comment). This corpus was then to be supplemented linguistically in the so-called term mode (with definitions and target language equivalences). A quick editing function was available for the conference and interpreting phase ("conference mode"). This mode also included quick search functions while interpreting, amongst others an innovative fuzzy search-algorithm, which yielded results even if the entered string contained typos. A log function was available for the conference follow-up phase. *Interpretbank* has been continuously developed ever since and is now available in version 6.

[6] A DOS-based version seemed to have existed even before (cf. Sand, 2004).
[7] For the definition of the term "CAI-tool" cf. section 4.

With *Intragloss* (apparently not available anymore), a third representative of this category became available some time later. It allowed for the first time to integrate documents directly into the user interface of a CAI tool in order to manually extract denominations into the underlying glossaries. The integrated documents could also be annotated automatically from the database and missing terms could be looked up automatically. The terminological entry model, however, remained as rudimentary as with the first generation tools.

In recent years, a *third generation* of applications has emerged using the possibilities of cloud computing. *Interpreter's Help* (interpretershelp.com; web-based; fee-based) in particular, but also *Flashterm Interpreter* (www.flashterm.eu; Win/Mac/IOS/Android and web-based; fee-based), offered the possibility of collaborative work on terminology databases via the Internet and run, thanks to a browser based solution, on all hardware platforms, including tablet computers and smartphones. *Interpreter's Help* relied entirely on an online implementation (but could also access locally installed terminological entries with the tool *boothMate*) and extended the collaborative functions to the management of interpreting assignments. However, its terminological entry model remained rudimentary, as with the first generation applications. *Flashterm Interpreter*, on the other hand, was also available offline and was the only application besides *LookUp Pro* offering a full-fledged terminology entry model with a large choice of micro-, macro- and metadata. Contrary to all other tools, it could also display all entries of a dataset at once in a form instead of showing only lists of denominations during the interpreting phase.

Looking at these products as a whole, the first thing that stands out is that - with the exception of *Flashterm Interpreter* - all tools presented are in-house developments by active interpreters[8], either individually or in conjunction with a few other people. In contrast to translation, there are no large companies - with the appropriate specialist staff and financial resources - behind the development and marketing of the available products. Even on the part of large international customers for interpreting services, there seem to be no guidelines nor initiatives to promote or standardize CAI. The possible reasons for this matter of fact have already been mentioned previously.

This lack of a uniform industrial standard goes hand in hand with the very heterogeneous functions and operation of the individual tools. If one takes the list of dedicated applications developed so far, it results (as of March 2020) that of a total of 13 developed products, eight belong to the so-called first generation, three to the second (*LookUp Pro*, *Interpretbank* and *Intragloss*) and two to the third (*Interpreter's Help*, *Flashterm Interpreter*). Out of all these applications, only two have a scientific background (*LookUp Pro* and *Interpretbank*).

---

[8] It should be noted however that the developer of *Flashterm Interpreter*, *Eisenrieth Dokumentations GmbH*, is primarily a consulting company and localization service provider, whose core competences have nothing to do with the development of CAI tools.

It is also striking that all but two tools (*LookUP Pro* and *Flashterm Interpreter)* are not actual terminology databases, but programs for managing simple word list: Thus, their entry model consists mainly of denomination equivalencies linked to glossary names. Basic terminological micro-, macro- and metadata such as definition, context, record number and date are not part of the underlying data categories and - unlike the terminological databases available for CAT - cannot be created by the respective user. There is also a lack of a standardized entry model and specific file format, so that more complex data records – containing more than the usual denominations and eventually the glossary name - can be neither created nor imported.

The lack of industrial implementation also leads to the fact that products are frequently discontinued or no longer maintained:

Thus, out of the original 13 applications, only seven are still available, but only three are being further developed or maintained: *Interpreter's Help*, *Interpretbank* and *Flashterm Interpreter,* 3/4 of the tools developed so far are therefore outdated or obsolete[9].

Furthermore, the three mentioned products are programs with very different focuses. *Interpreter's Help* is a simple glossary application without terminological macro- and metadata or automation functions, but with extensive cloud connectivity for coordinating interpreting assignments or communicating among colleagues and exchanging or mutually editing glossaries. *Interpretbank* is an almost completely automatable software with little predefined macro- and metadata, which moreover cannot be displayed in all phases, and has no collaborative functions. *Flashterm Interpreter* has a complex entry model and can be used collaboratively, but there are no automation features for the rich data structures, so that a full use of all entry categories is rather unlikely.

As with CAT, core and additional functions can be identified in the available tools. Central to each application is an editable terminological database that can be queried in the interpreting phase ("booth mode" or "conference mode") via customizable search and sorting functions. Depending on the generation, additional functions include automation aids for filling and using the database outside the interpreting phase (corpus creation, term extraction, definition search, etc.).

More generally, the situation for CAI tools can be summarized as follows:

- There are significantly less industry-specific applications for interpreters than for translators. The use of CAI is not a prerequisite for the award of an assignment.

---

[9] *DolTerm* (no longer available); *Glossarmanager* (latest version available: 2008); *Glossary Assistant* (latest version available: 2015); *Glossary Pro* (no longer available); *Interplex* (latest version available: 2015); *Interpretbank*; *Interpreter's Help*; *Interpreter's Wizard* (no longer available); *Intragloss* (the former site intragloss.com is currently down, the once publicly available video demos have disappeared); *LookUp Pro* (no longer available); *TermdB* (no longer available); *Terminus* (last version available: 2009); *Flashterm Interpreter*.

- No tool offers a free entry structure; most applications are pure glossary management programs. Without a standardized entry model, data exchange is problematic and takes place via an unspecific format (usually *Excel* or *CSV*).

- Most CAI-tools are heterogeneous, ad-hoc solutions from individual practitioners and do not rely on scientific nor industrial support.

- Less than ¼ of all tools ever developed is still available and maintained today.

3. The Use of CAI among Interpreters

It seems clear that the circumstances just described do not necessarily contribute to a widespread use of CAI. In fact, for many years now, studies and surveys have repeatedly shown a relatively low rate amongst interpreters (cf. SDI, 2007; Bilgen, 2009, p. 61; Berber-Irabien, 2010, p. 205ff.; Barbagianni, 2014; Corpas & Fern, 2016, p. 34; Atabekova et al., 2018, p. 358).

However, newer surveys seem to indicate an increasing percentage. In her master's thesis with 102 conference interpreters in Germany for example Wagener, (2012, p. 73) comes up with a 26% share. Four years later, in a worldwide survey of 133 interpreters from different fields, Corpas and Fern (2016, p. 34) conclude that 48% of all interpreters use CAI - a figure that seems to be confirmed with 50% in the follow-up survey of 32 interpreters in the USA, mainly from the social sector (Corpas, 2018, p. 163). However, the underlying research is very heterogeneous in terms of methodology and content and not representative due to the small population, so that it might only indicate a certain tendency.

There is, however, a consensus that interpreters mainly work without CAI for which various reasons are identified:

Many authors stress that interpreters reject the use of new technologies but also cite a certain ignorance as regards CAI, also on the part of the training institutions (e. g. Bilgen, 2010, p. 205; Corpas Pastor, 2017, p. 7; Fantinuoli, 2018, p. 163). Lack of familiarity (Kalina, 2010, p. 88), preference for office software (Wagener, 2012, p. 21) and skepticism about the available options (Corpas & Fern 2016, p. 34, Prandi, 2017, p. 76) are also mentioned.

While these arguments suggest that there might be an information deficit among interpreters concerning the use of CAI, other reasons also seem to be conceivable.

For example, Farwick (2009, p. 72) points to a possible mental overload, especially during the interpreting phase. The latter is supported by the relatively large case studies of Corpas and Fern (2016) and Atabekova, Gorbatenko, Shoustikova and Valero-Garcé (2018) which show that interpreters who regularly

use CAI tools and other electronic aids do so mainly outside the interpreting phase[10]. In fact, the use of a PC for interpreting requires supplementary cognitive resources or efforts[11], which further aggravate the already heavy attention sharing during the interpreting phase (Will, 2000, p. 133 and Will, 2015, p. 186)[12]. On the other hand, it can be assumed that the use of suitable CAI systems will not only improve the quality of interpretation as regards the use of correct terminology, but may even reduce the cognitive load during the interpreting phase (Prandi, 2017, p. 81). This was also the basic assumption at the beginning of CAI, combined with the insight that such multitasking capacities are to be trained.

However, there is little research to date on how exactly the use of CAI tools, especially during interpreting, affects the final product. Furthermore, the studies made so far seem to be qualitatively and/or quantitatively not very robust[13].

Moreover, basic questions as to how CAI tools are to be operated and what information should be displayed how during the different phases of an assignment have not yet been researched (Will, 2015, p. 196 ff.). In this respect, the observed technology gap in interpreting could also be explained by the fact that the available products do not or do only partially meet the requirements of interpreting (Will, 2015; Ortiz & Cavallo, 2018, p. 12). This will be discussed again at the end of this contribution.

Another problem is the inconsistent use of terms such as "CAI" or "CAI tools" in the literature. On the one hand side, they are mostly used in relation to the interpreter's knowledge management or interpreting-oriented terminology work (IOT, cf. Will, 2009), i.e. in the context of a structured workflow with the aim of delivering an adequate interpretation. Thus Desmet, Vandierendock and Defrancq (2018, p. 17) consider CAI tools as "applications [...] that are designed to support the interpreter in the various phases and processes of interpreting itself, e.g. for the acquisition, organization and retrieval of information, both before and during an assignment." Fantinuoli (2018) also sees CAI as supporting the interpreting process ("process-oriented") and the underlying acquisition and use of terminology (terminology work) and distinguishes this from the use of computer technology for the transmission of the final product („setting-oriented"). Carl and Braun (2018, p.

---

[10] In their survey with 133 respondents, Corpas and Fern (2016, p. 34) conclude that 48, 12% of interpreters used CAI tools while interpreting; in another study involving 111 participants, Atabekova et al. (2018, p. 362) found a usage ratio of 42%.

[11] The corresponding effort-model stems from cognitive psychology and has been formulated by Gile (1995, p. 90) to illustrate the cognitive capacity distribution in interpreting.

[12] Prandi (2017, p. 80 ff.) presents a differentiated evaluation of the cognitive load in simultaneous interpreting illustrated by the use of an Excel-glossary during the interpreting phase. To do so, she relies on Seeber's Cognitive Load Model (Seeber 2007), which considerably enlarges Gile's effort-model (ibidem).

[13] It seems that so far all available studies have been conducted almost entirely with students and involving only a small number of participants. The results in Xu (2015) are based on 16 students, those in Gacek (2015) on 8 participants of which 7 were students. For a summary of the related works cf. Prandi, 2017, p. 76.

3) actually speak in this latter respect much more clearly about "ICT-supported interpreting."

Other authors, however, take a much broader view on CAI. In principle, they seem to include all digital devices or products that are (or can be) used by interpreters in any way or that might play a role in the exercise of their profession. Thus, authors such as Gacek (2015, p. 16) include search engines or online libraries in the definition of CAI, while Costa et al (2014, p. 30) mention unit converters and Ortiz and Cavallo (2018, p. 17 ff.) note-taking software, audio and video conference systems or learning platforms.

4. Definition CAI and CAI Tools/Systems

Following Desmet et al (2018), the term CAI (for Computer Aided/Assisted Interpreting) will be understood as merely process-oriented. CAI thus encompasses the use of a PC or other hardware in conjunction with applications operated by it, which either *completely or at least partially automate* tasks within the workflow leading to the final product, the interpretation, delivered by the human interpreter.

In line with Fantinuoli (2018), it is also understood that CAI is mainly aimed at the acquisition and use of terminological knowledge in the context of an interpreting assignment. Furthermore, it is assumed that the ensuing workflow can be adequately described through the phase model of interpreting (Will, 2000, 2008, 2009, see also section 5 of this contribution).

As the machine is not yet able to deliver reliable and adequate results autonomously, CAI is understood as means to *support* the human interpreter in the generation and use of terminological knowledge in the different phases of an interpreting assignment and the respective resulting workflow. In this regard, it seems advisable to differentiate the definition of CAI and related collocations into:

- *Primary CAI* to support the interpreting phase. This concept covers the use of any computer-based applications within an ongoing interpretation to retrieve previously constituted terminological structures so that they can be integrated in the final product. Due to the specific textual conditions of the interpreting phase, special cognitive and ergonomic requirements have to be taken into account as regards the software and its operation. All tools developed specifically for interpreters as presented under section 2 claim to be fit for primary CAI.

- *Secondary CAI* to assist the preparation of the final product outside the interpreting phase. This concept covers the use of any computer-based applications to search, compile and record terminologically relevant structures for a subsequent interpretation. As a result, special cognitive or ergonomic requirements such as those for primary CAI are not necessary, so that specialized tools for interpreting appear less important here. In fact, the vast majority of secondary CAI tools presented in this contribution do not have any interpreting background.

- *CAI tool* refers to the application installed on or controlled by a computer (e.g. over the Internet) for carrying out primary and/or secondary CAI. An application for primary CAI shall be called *primary CAI tool*, one used for secondary CAI purposes, *secondary CAI tool*. Software enabling primary as well as secondary CAI should be referred to as an *integrated CAI tool*. So far, only three integrated CAI tools have ever been developed: *LookUp Pro*, *Intragloss* and *Interpretbank*.

- *CAI system* shall mean the hardware used to run a CAI tool. Even though this point is rarely mentioned in the literature, it is obvious that the hardware has a significant influence on the use of *Computer* Aided Interpreting tools (through factors such as computing capacity, screen size and resolution, existing ports and control elements, or last but not least through the compatibility with a specific operating system). Certain systems are therefore less or not at all suitable to run (certain) CAI tools. More about this under section 5.

All other tools or technologies (e.g. for transmission and reception of video and audio signals, for communication between interpreters, continuous speech-to-speech solutions, etc.) are considered separate ICT applications. They will not be addressed in this contribution.

5. Phase Model of Interpreting as a Framework for Primary and Secondary CAI

5.1. *Preliminary Remarks*

This section deals with the subdivision of an interpreting assignment into different stages (or "phases"), each of which is related to specific working conditions and objectives in human interpreting. In the following, the different phases will be shortly described and then used as a referential framework for the use of the CAI tools described later on.

The structured model of and interpreting assignment and the related workflow in relationship to a specific knowledge management was first conceived by Will (2000) and led to a subdivision into 3 main *phases* and 3 *sub-phases*. This approach was conceptually refined in Will (2008) and (2009). Today, the ensuing „phase model" of an interpreting assignment and the inherent (terminological) knowledge management (IOT) belong to the state of the art and are the base for products such as *Interpretbank*.

Kalina (2002) adopted the same approach in a slightly shortened form, calling the different phases first "pre", "peri", "in" and "post" but without ever referring to Will (2000) nor explaining how she derived her model; some years later, she reverted to using only the term "phases" (Kalina, 2005). This has created some confusion and wrong citations in the literature as to the authorship of this concept and even the original idea. That is why it is important to refer here once again to the original concept and author (Will 2000, 2008, 2009) of the subdivision of an

interpreting assignment in various "phases" for the purpose of modeling the interpreters' workflow and inherent knowledge management.

5.2. *Phase Model*

The starting point of the phase model in interpreting is the observation that in (simultaneous) human interpreting the translation must be produced within a few seconds (within the ear-voice-span) and in parallel with the reception of the original. The textual conditions are thus so unfavorable that only existing knowledge or externally stored or generated information can be retrieved.

Therefore, both the previous constitution of adequate knowledge outside the interpreting phase and its storage in the brain or on external data carriers - as well as its timely retrieval - are the prerequisites for the successful production of a target text. Contrary to written translation, the necessary knowledge acquisition can only be achieved through parallel texts. The problem arises, however, that with increasing time and situational distance from discourse (and the phase of interpretation), the availability and relevance of possible parallel texts become more and more uncertain. This situation improves in the opposite case, but then there are less time and resources to retrieve terminology from available, more relevant parallel texts (e.g. parallel discourses).

This context leads to a specific workflow, which, as already mentioned, is divided into 3 main and 3 sub-phases: (I) Conference preparation, (II) Conference phase - with the subphases (IIa) Interpretation preparation, (IIb) Interpretation and (IIc) Interpretation follow-up – and finally (III) Conference follow-up.

This is also the reason for the distinction between primary and secondary CAI.

After having introduced the phase model, the ensuing workflow as regards IOT will be briefly discussed, followed by the presentation of primary, secondary and integrated CAI tools that are already available today. In a further step, it will be analyzed to what extent these tools meet the requirements of the respective workflow.

6. IOT: Workflow

Broadly speaking, the various phases of the above mentioned model contain the following steps (Will, 2000, 2008, 2009):

6.1. *Conference preparation*

(1) Parallel texts that are considered relevant for a given interpreting assignment are selected.

(2) The selected texts are analyzed and relevant source-language denominations extracted.

(3) The individual meaning of the selected terms is gathered via their context.

(4) A definition for each term is established as well as a link to a superordinate knowledge system (taxonomy).

(5) The previously collected micro- and macro data are completed by administrative metadata (e.g. date of entry, source, subject, customer reference).

(6) The collected knowledge systems are ranked with regard to their importance for the upcoming conference based on their frequency and distribution in one or all selected parallel texts.

(7) The target language structures are collected in parallel to the structures in the source language.

6.2. *Conference Phase: Preparation and Follow-up of Interpretation*

The same steps (1-7) are carried out here as for conference preparation, but in less detail and with reference to a past or forthcoming discourse or individual parallel texts available at short notice. The emphasis is on establishing micro data - steps (2), (3) and (7).

6.3. *Interpreting Phase*

(8) During the reception of the original, terminological knowledge is retrieved, either from memory or on the basis of externally stored structures.

(9) The externally retrieved source-language terms are disambiguated in order to select an adequate target-language term.

(10) The selected target language terms are integrated into the ongoing interpretation.

6.4. *Conference Follow-up*

The same steps (1-7) are carried out here as for conference preparation, in order to supplement structures that were partially created during the conference phase. In addition:

(11) The type and number of entries created during the conference preparation phase are compared with the structures created or retrieved during the conference phase for the purpose of quality assurance. In this regard, an evaluation takes place on the basis of:

- Which terms were searched for in the conference phase (= the required, not memorized terminological knowledge).

- Which terms were created in the conference phase (= the required, not previously collected terminological knowledge).

- Which terms were already constituted before the conference phase (= the existing terminological knowledge).

7. CAI Tools

In the next section, CAI tools already available today are introduced and examples given how they can be used in the individual phases and steps of an interpreting assignment[14]. This is followed by a critical evaluation of the existing functions.

7.1. *Conference Preparation (I)*

Step 1: *Corpus managers* such as *BootCat* (bootcat.dipintra.it; Win/Mac/Linux; freeware) or *Sketch Engine* (www.sketchengine.eu; web-based, fee-based, which offers significantly more features than *BootCat*), automatically collect texts in a specified source language from the World Wide Web and regroup them in a corpus for further analysis. The relevance of the corpus as regards a given assignment can be influenced through the input of one or more keywords chosen by the human interpreter. Most corpus managers also foresee supplementary parameters as the choice of a specific search engine, the inclusion of stop words, the total number of URLs or web queries to be collected as well as the deselection of collected URLs. Extracted results can be used for further searches, so that even more relevant corpora can be created.

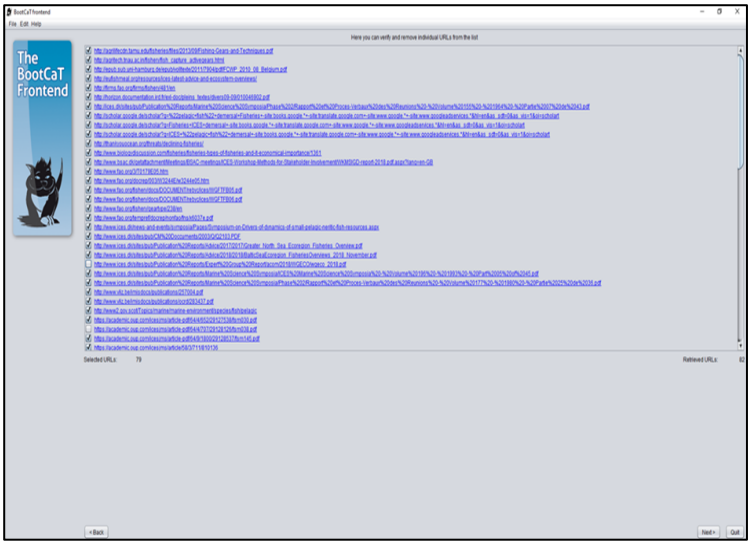


Figure 1. *Corpus manager (BootCat)*: List of URLs, automatically collected on the base of the subject area "fisheries". Every line can be manually deselected (unchecked boxes) before the final corpus is constituted

Interpretbank is equipped with a corpus manager.

[14] The graphical examples in this section are merely illustrative in order to show how selected tools display data in different steps. This is done for a fictitious assignment in English and German around the topic "fisheries"/"Fischerei".

A useful addition to corpus managers are semantic networks, which display related terms and their relationship to a specific source term. They can be used to gather relevant keywords for the constitution of a given corpus (or get a "quick glance" at the semantical extension of a given term, f. i. a given conference topic). Various web services, such as the EU-funded project *Terminology as a service* (*TAAS*)[15] or *Babelnet* (babelnet.org; free of charge), are capable of automatically generating semantic networks.

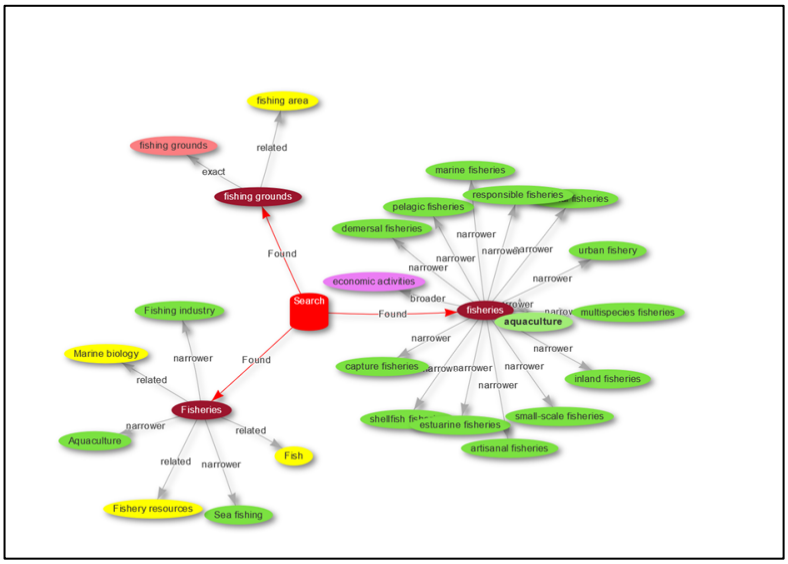


Figure 2. *Semantic network automatically generated around the source term "fisheries"* (Source: *tilde terminology*)

Step 2 and 3: Using *corpus analysis programs* such as *AntConc* (www.laurenceanthony.net; Win/Mac/Linux; freeware), *Sketch Engine*, *Wordsmith* (lexically.net; Win; cost-based) or *Webcorp* (www.webcorp.org.uk; web-based, free of charge), given monolingual texts (individual documents, automatically generated corpora or manually compiled text collections) can be automatically analyzed and evaluated in connection with certain criteria. For example, this software extracts word lists (single and multi-word denominations), sorts the results according to their frequency and displays the distribution in the underlying texts. Depending on the application, the analysis may include or exclude word classes (verbs, nouns, adjectives etc.) or certain words by means of a stop word list. Terms that occur frequently in a corpus can be considered as particularly relevant for the text selection, especially if they are displayed in several or all examined texts.

[15] Available free of charge through the website of a project partner, *tilde terminology* (term.tilde.com).

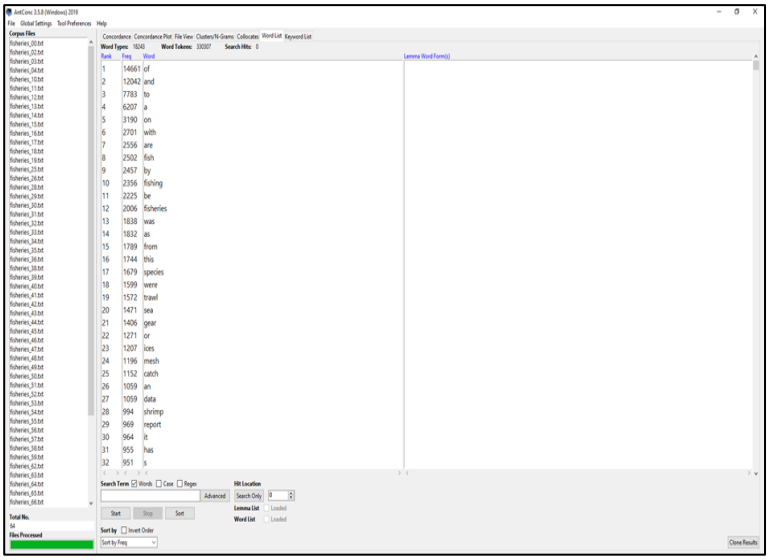


Figure 3. *Corpus analysis program AntConc*: List of word frequencies in descending ranks. The list shown is based on the corpus extracted by *BootCat* in relation to the subject area "fisheries"(as shown in Figure 1) which yielded 52 texts altogether

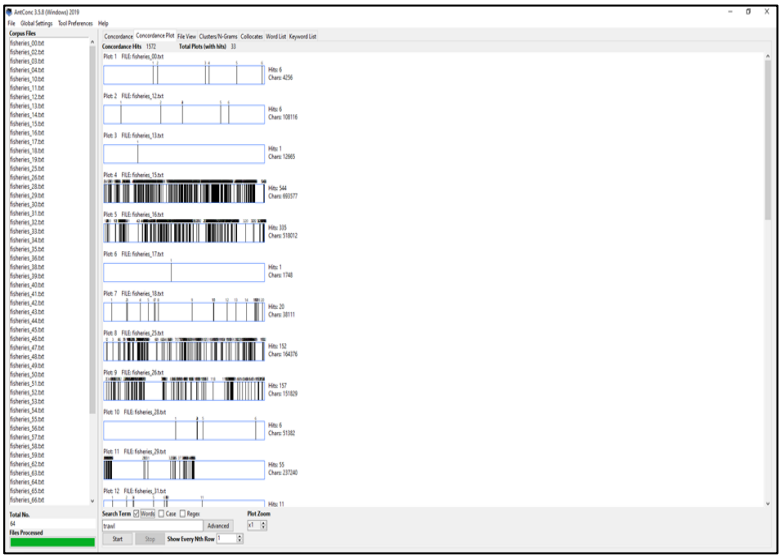


Figure 4. *AntConc*: Graphical distribution of the denomination "trawl" per text within the extracted corpus for "fisheries" in step 1. The horizontal squares (right) represent the individual texts (whole extracted list of texts on the left side), the vertical lines and their position within stand for the occurrences of "trawl" in every text

In comparison with a large, common-language reference corpus, it is also possible to generate (subject-specific) "keywords" which either occur only in the collected corpus or which occur there significantly more often than in the (general-language) reference corpus. For each word or keyword, the corresponding context can be displayed (concordance).

Interpretbank includes a corpus analysis tool with concordance function and keyword capture. However, it does not show the distribution of words in the corpus. *Interpretbank*, as well as *Intragloss* and *Interpreter's Help* also offer a simple manual term extraction from imported documents.

Bilingual term extraction programs such as *Synchroterm* from *Terminotix* (terminotix.com; Win; cost-based) or *SDL Multiterm Extract* from *Trados SDL* (www.sdltrados.com; Win; cost-based), have been specifically developed for CAT. These programs are capable of processing not only monolingual texts, but also texts that exist in two languages, in this case aligned translations. From these, they can automatically or individually extract single and multi-word denominations in one or simultaneously in two languages with their context according to their frequency and transfer them in a terminological database with editable fields. The contents of the database can then be imported into another application (e.g. a tool for primary CAI), provided that this application includes the corresponding data fields. Bilingual extraction applications thus cover several aspects of IOT and can handle the basic steps (2, 3, 5 and 7) of phase (I) and (IIa) almost without human interference.

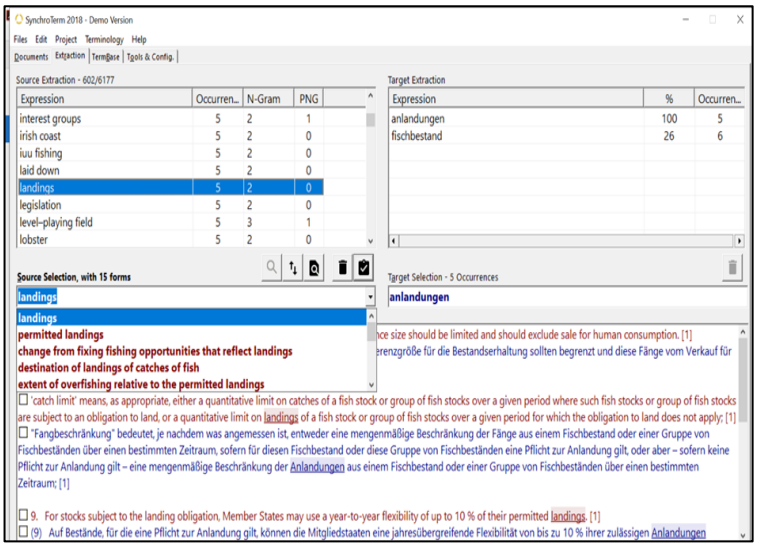


Figure 5. *Bilingual term extraction with Synchroterm*: Here, a source denomination ("landings") is displayed together with concordances, context information and their equivalencies from an aligned target text

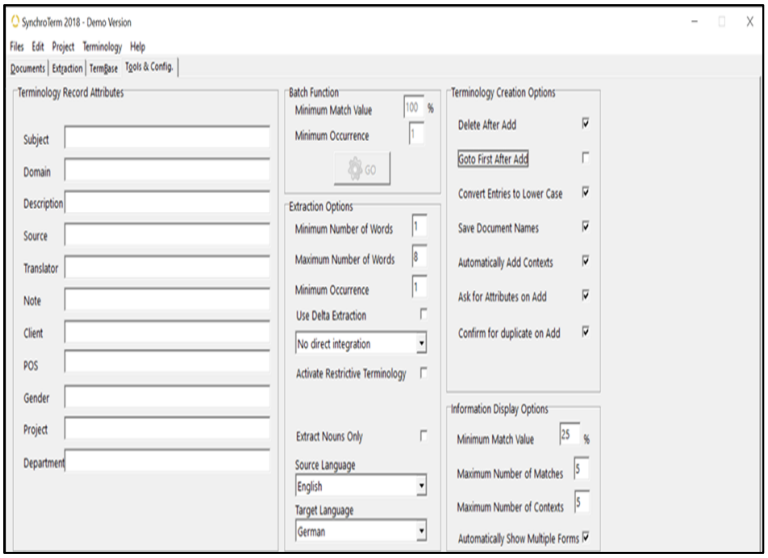


Figure 6. *Synchroterm configuration*. Automatic term extraction (batch function, center, top), general parameters (center; right) and term base (left) with the available entry fields

Step 4: Currently, there seems to be no software that automatically collects definitions for given denominations and links them with a knowledge system or taxonomy. However, the manual effort involved can be reduced by using script programs[16] in conjunction with Internet services such as *2Lingual* (www.2lingual.com; free of charge), terminology databases such as *IATE* (iate.europe.eu; free of charge)[17] or multilingual, semantic encyclopedias such as *TAAS* or *Babelnet*. The latter, by the way, has announced to soon offer a function (*Extraggo*) that would allow extracting knowledge systems from texts.

[16] Which can be individually compiled f.i. through a user-friendly scripting language such as *Autohotkey* (www.autohotkey.com). Another possibility is the use of readily available script collections with a link to translation and terminology, such as *GT4T* (gt4t.net; Win/Mac, partially cost-based).
[17] The entire content of the database is also available for download (zip file; free of charge).

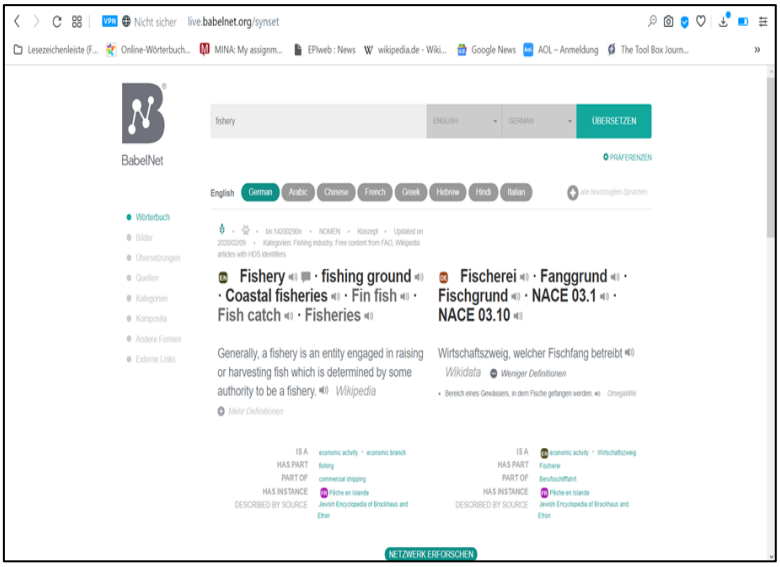


Figure 7. *Babelnet*: Bilingual (English/German) query result for "fisheries"/"Fischerei" with definitions and embedding in taxonomies (via semantic categories: "IS A", "HAS PART", "PART OF" – center, bottom)

Interpretbank and *Intragloss* contain comparable functions for capturing entries from pre-configured web services, e.g. *IATE* or *Wikipedia*.

Step 5: Although the entry model of most primary and integrated CAI tools is very limited (and only contains one field for metadata, usually for the name of an associated glossary name), the automatic inclusion of pre-established metadata (mostly, as mentioned, the glossary name) is one of the basic functions of all primary or integrated CAI tools and will not be discussed further here.

Step 6: As there seems to be no tool for the automatic linking of terms to knowledge systems from texts (see step 4), their distribution and relative importance within a given corpus has to be inferred from the associated denominations. It has already been mentioned that some corpus analysis programs (e.g. *AntConc*, *Sketchengine*, *Wordsmith*) offer the possibility to display the distribution of the extracted denominations in connection with the underlying text selection - be it in tabular or graphical form. However, they lack dedicated graphical visualization features offered by other tools (which are mainly used in comparative literature or corporate communications) such as *Voyant Tools* (voyant-tools.org; web-based, free of charge) or *Wordstat* (provalisresearch.com; Win; cost-based). These latter tools automatically generate complex, configurable graphical overviews in the form of *word clouds*, *collocation frequencies* or *distribution plots*, which, for example, visualize all or a chosen subset of denominations or collocations of a corpus according to their frequency. This, in turn allows to draw conclusions about the

importance and distribution of associated knowledge systems. The graphical visualization of language data is an interesting possibility to quickly seize relevant terminological information about one or more texts.



Figure 8. *Voyant Tools*. Graphical overviews: From left to right: *Word Cloud* (with the most frequent denominations), *term berry* (the most frequent denominations as well as the collocate frequency between them for "fishing"); *distribution plot* of "fishing" (marked dots) throughout the corpus from an English source text

Step 7: Can be done using automatic translation programs such as *DeepL* (www.deepl.com/translator)[18], *Systran Translate* (translate.systran.net; free of charge) or *Google Translate* (translate.google.com; free of charge). The source language terms (e.g. from an automatic, monolingual term extraction) are copied in list form into the input field and the translations are extracted via copy and paste.

Another possibility is the use of *bilingual, corpus-based concordance programs* such as *Linguee* (www.linguee.de; free of charge*) or Glosbe* (glosbe.com; free of charge), which automatically extract source and target equivalencies including their context from large web repositories.

Intragloss compares source language terms in a document with identical entries in its own database and then enters the existing target language equivalents in the

[18] *DeepL* (partially cost-based) can be downloaded as a desktop application (Win/Mac; free of charge) for an improved text management.

document. In addition to this function, *Interpretbank* also provides for an automatic translation of monolingual terms that are currently not part of its database. Both *Intragloss* and *Interpretbank* can automatically search for target language equivalents in a list of web services such as *Linguee* or *IATE*.

7.2. *Conference Phase (II):Preparation (IIa) and Follow-up of Interpretation (IIc)*

The workflow in these two sub phases corresponds to a selective implementation of steps 1- 7 from phase I and will therefore not be discussed further.

7.3. *Interpreting Phase (IIb)*

Step 8: Since there is currently no reliably speech-to-text application that automatically extracts source language terms from discourse and displays them with their target language equivalents, all primary and integrated CAI tools currently available offer only semi-automatic functions for the interpreting phase, within a so-called "booth mode". A source language search string is manually entered into a query field, whereupon the machine displays the corresponding denominations in list form next to their corresponding target language equivalents (and possibly other micro-, macro- and/or metadata). The results shown depend on the selected search methods, which are quite heterogeneous and vary with the respective CAI tool. The following parameters are currently available:

Search by *part of the field* (hits contain search string), search by *whole field* (hits consist only of the search string), *dynamic* search (the hits displayed change with the characters introduced in the query field), *field-sensitive* search (the search is limited to a specific field), *accent insensitive* search (bypassing accents and/or diacritics), search *in a specific order* (e.g. by descending date or thematic sequence), *fuzzy* search (to bypass input errors), search *for an automatic translation* (Internet).

Most primary and integrated CAI tools can combine several parameters. All of them offer at least a search by part of the field in order to minimize the input effort in the interpreting phase. *Interplex* and *Interpreter's Help* also offer an accent insensitive search. Only *Interpretbank* offers all of the above-mentioned search parameters.

Step 9: Has to be done by the human interpreter, as there is currently no CAI tool available for the automatic disambiguation of terminological results displayed by the machine in step 8.

Step 10: Does not fall under the definition of CAI and is solely the task of the human interpreter.

7.4. *Interpretation Follow-up*

The workflow in this phase (adding of missing structures for completing partial entries from the conference phase) corresponds to a selective implementation of steps 1- 7 from phase (I) and will therefore not be discussed further.

7.5. *Conference Follow-up (III)*

Step 11: So far, there is no CAI tool that allows a detailed statistical analysis of terminology data as specified under section 3. However, *Interpretbank* includes a *query log* that provides raw information on the performed search operations.

Using *pivot functions* of databases or spreadsheets, a partial, semi-automatic evaluation can also be carried out on the basis of the input date (number of entries in the conference phase in relation to the number of entries, e.g. within conference preparation).

At the very least, this allows to trace possible deficits to be documented within the framework of quality assurance.

8. Evaluation

The different CAI tools discussed under the previous section show that already today automation possibilities exist for most aspects (in 7 of 10 possible steps) of the workflow derived from the phase model of interpreting. So far, only the automatic generation of taxonomies (step 4, conference preparation), the entry of search strings (as part of step 8, interpreting phase), the disambiguation of displayed hits (step 9, interpreting phase) and the statistical evaluation of terminology work (step 11, conference follow-up) are left out. There are still no (reliable) or only rudimentary CAI options available here.

Interestingly, almost all secondary CAI tools come from corpus linguistics and have already been used for some time in CAT. The high degree of automated routines is another long-standing feature of CAT, which entered CAI only recently.

The advantage of the secondary CAI tools (*corpus manager, corpus analysis* and *term extraction*) is their ability to analyze large amounts of data in a fully automatic way and to deliver results in machine-readable form. The "reading" of the texts and the extraction of terminology by the machine means a considerable gain in efficiency for the human interpreter (cf. Pérez-Pérez, 2018, p. 149). This advantage can also be used strategically, for example during the preparation of an interpretation, where a bilingual term extraction of a newly available large document may deliver valuable results in very little time (or an even quicker check of the document with a visualization tool). But secondary CAI tools may also lead to quality improvements, for example by showing different or dominant usage contexts of extracted terms (concordance; collocation frequencies).

However, there are also disadvantages. They are due to the fact that secondary CAI tools are applications that mainly have a statistical background. This means that the results are focused on general tendencies rather than on individual data that can be related to a specific context. This is reinforced by the fact that when

automatically compiling a text corpus via a corpus manager, the result does not only depend on the keywords entered, but also on the respective application and its parameterization[19]. For this reason, the use of corpus managers followed by concordance programs is more suitable for getting a first impression of possible terminological focal points of an upcoming assignment. It cannot replace the analysis of a given conference documentation. The same applies to *semantic networks*, which do not start from an individual text level, but from encyclopedic collections at system level, which, in addition, contain numerous terminological gaps.

If, on the other hand, a dedicated conference documentation is available for a specific assignment, a corpus analysis will almost certainly yield relevant results for this individual context. However, the existing texts have to be edited, since some file formats are not easily readable for many concordance programs, such as presentations (*.ppt) or pdfs without OCR (Optical Character Recognition). It is also advisable to edit a stop word list in order to exclude words with less meaning (e.g. prepositions, determiners) from the results to make them more readable.

As the discussed applications produce frequencies of character combinations rather than meaningful content, it might also be quite cumbersome to detect relevant term candidates. This is especially true for monolingual concordance tools, whose word lists do not contain context information. This means that the semantic content of each single or multi word denomination in the list hast to be checked individually. For example, one-word denominations such as "market" and "organization" may occur very frequently (and in different concordances) in a corpus, but the bigram "market organization" may occur only a few times and the multigram "common market organization in fisheries" perhaps even less. In the same time, the frequency lists contain also many word combinations that have no semantic relevance or are even totally meaningless - f. i. character strings, which are created by separators (the so called "noise"). This, as well as the sometimes long computing times, can lead to a certain degree of frustration, as the human interpreter does not deal any longer with coherent texts but with atomistic structures. This allows on the one hand side to save a considerable amount of time, but also results in a loss of information (contexts, argumentation structures and possibly rare terms). Shorter, single texts are therefore less suited for concordance tools.

As regards the discussed visualization tools such as *word clouds or collocation frequencies*, they are certainly interesting in themselves because of their simplicity, rapidity and meaningfulness. However, most visualization tools display only one-

[19] Thus, many applications support only specific search engines and are limited in their configuration as regards f. i. the exclusions of stop words. In this regards, it should also be noted that it is not known how, based on given keywords, a search engine like Google selects the resulting URLs. This remains a trade secret of its owner. Furthermore, the majority of Internet pages is not to be found in the WWW but in the so-called Deep Net, which is neither indexed nor accessed through search engines. Results also noticeable differ, if a corpus is manually and not automatically constituted and analyzed (cf. Fantinuoli 2006, p. 186).

word denominations and thus only a part of the overall terminological content of a given corpus.

Although *Machine Translation* has made considerable progress in recent years thanks to artificial intelligence, its textual output is still far from perfection and needs more or less robust post editing. Nevertheless, technical terms pose less problems, as they are far less ambiguous than common language words. Therefore, they tend to be translated more accurately by the machine than individual sentences or texts. This is especially true for well-developed language combinations, such as English-German. However, this does not exclude recurring dropouts and important differences between the single engines. Here are some examples: A prominent difficulty for many (public, untrained) automatic translation tools are terminologizations. F.i. the meaning of the German denomination „Pfanne" in medicine stands for an articular cavity. Here, *DeepL*, *Systran Translate* and *Google Translate* only suggest "pan" or "ladle" (referring to cooking or metallurgy) but do not contain any reference to a medical usage.

However, there are also problems with quite unambiguous technical terms. Thus, *DeepL* translates the English legal term "tort" (in the sense of "wrong"- which in German would be a "Delikt" or "unerlaubte Handlung") with "Schadensersatzrecht" ("tort law"). *Systran Translate*, even more surprisingly, suggests „zerrissen" ("torn", "ragged") and changes even a noun into a verb. Only *Google Translate* delivers with "unerlaubte Handlung" a correct translation.

While these problems might also relate to missing context information in the source language, even multi-word denominations can be translated incorrectly. Thus, *DeepL* translates "national organizations of agricultural markets" with "nationale Organisationen der Agrarmärkte". The source syntagm can be found e.g. in Council Regulation (EC) No 1234 from 2007[20] and was correctly translated as „einzelstaatliche landwirtschaftliche Marktordnung" in the official German translation on EUR-Lex, the legal information system of the EU (eur-lex.europa.eu; free of charge). *DeepL's* misleading translation is even more astonishing as the engine is based on the multilingual, web-based concordance tool *Linguee*, which has a direct access to all aligned and public translations of the EU institutions[21].

As expected, idiosyncrasies might also create difficulties: Thus, *DeepL* converts "dolmetschorientierte Terminologiearbeit" (interpreting-oriented terminology work) into "interpreting terminology work". Retranslated, this then becomes "Dolmetschen von Terminologiearbeit" ("interpreting of terminology work").

---

[20] Full title: "Council Regulation (EC) No 1234/2007 of 22 October 2007 establishing a common organization of agricultural markets and on specific provisions for certain agricultural products (Single CMO Regulation)".

[21] Actually, this terminological faux pas stays on even if the full title (and thus a complete context) of the relevant regulation is given. The same applies for *Systran Translate* and *Google Translate*.

These examples show that, despite all the advantages, a complete or high degree of automation with secondary CAI tools (still) requires human control, which, in turn, reduces the efficiency gains obtained beforehand.

And there are also limitations to the *booth mode* of primary or integrated CAI tools. They relate to the displayed data categories as well as to the cognitive effort required to retrieve them during the interpreting phase. Thus, most tools do not offer a data mask which relieves cognition f. i. by avoiding unnecessary eye jumps (cf. Will, 2015, p. 197); furthermore, the displayed entry models are mostly too rudimentary, which strongly limits a reliable disambiguation and use of the retrieved target denominations. Here are three very heterogeneous examples:

With *Flashterm Interpreter*, the core structures (search field/string and denomination equivalencies - top left – Figure 9) are located one below the other and require hardly any eye movement. The complete data set with numerous data categories for disambiguation is displayed on the same screen to the right and thus rapidly retrievable[22]:

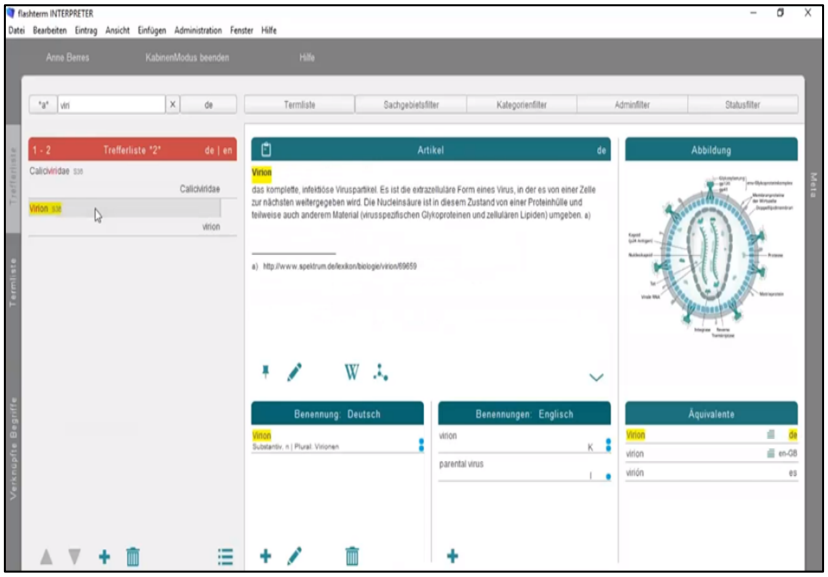


Figure 9. *Flashterm Interpreter:* booth mode. Source: *Flashterm*

With *Interpretbank*, the core structures (search string/field: bottom center, and denomination equivalencies: top left, center and right – Figure 10) are separated one from each other and require some eye movements. The only data for disambiguation displayed ("glossary name": top left) requires additional eye movements. The entry

[22] However, *Flashterm Interpreter* will only show the complete data set during booth mode if the corresponding denomination equivalences are clicked on – which requires thus a supplementary *effort* during the interpreting phase.

model seems therefore not suited for a reliable disambiguation during the phase of interpreting (IIb):

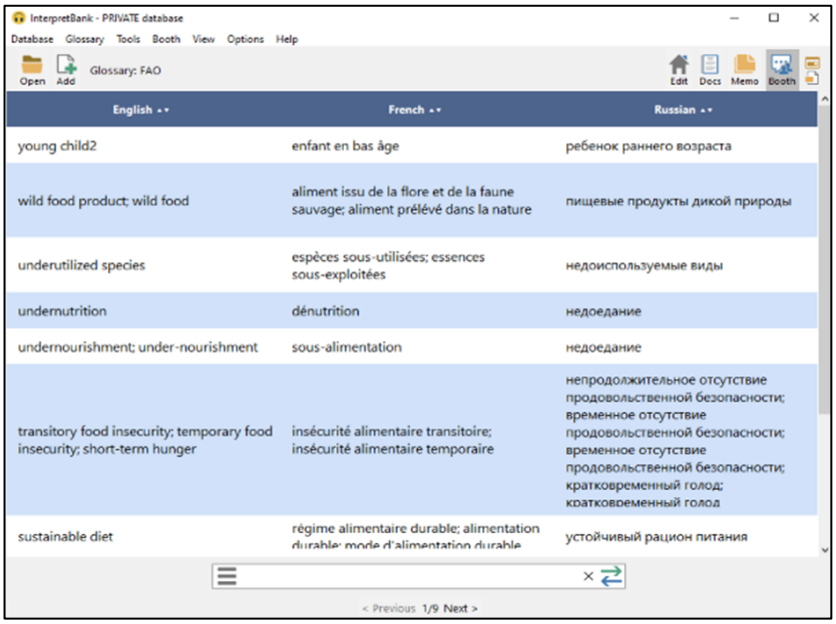


Figure 10. *Interpretbank 6*: booth mode. Source: *Interpretbank*

As for *Intragloss*, the core structures (search string/field: center right, and denomination equivalencies: top left, and bottom left – Figure 11) are far away from each other and require several eye movements. The only data for disambiguation displayed ("glossary name": above center and "remarks": underneath and below, to the right of the source and target denominations) require additional eye movements. The entry model seems therefore not suited for a reliable disambiguation during the phase of interpreting (IIb):

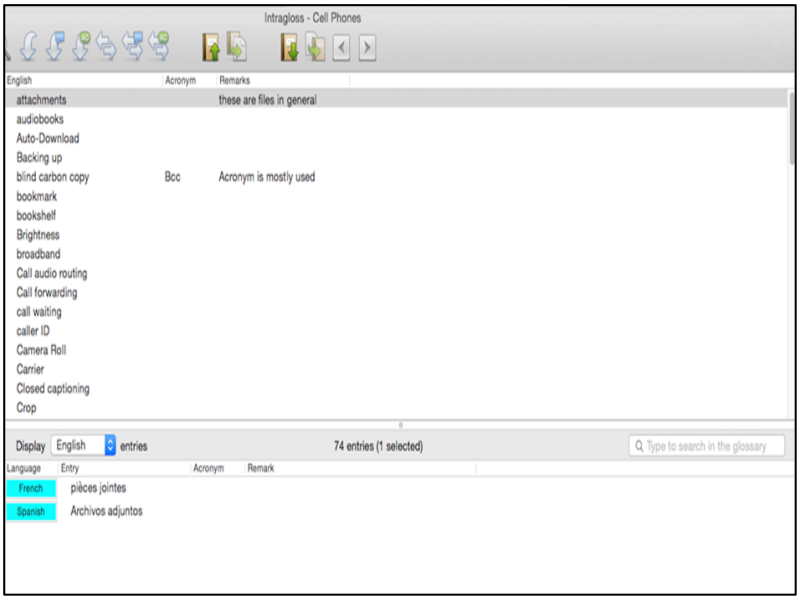


Figure 11. *Intragloss*: booth mode. Source: Goldsmith (2017)

Especially the last two examples show that these conditions make working with third-party glossaries a risky undertaking, but also generally reduce the usability of such CAI tools in the interpreting phase; an odd situation, as CAI originally set out to increase the efficiency *and* quality of the IOT.

In this regard, there seems to be at least some ground for the skepticism of interpreters towards CAI tools mentioned in section 3.

Another important aspect related to the *booth mode* is the question on which *hardware* to run a particular CAI tool: Currently, as already mentioned, a sequence of characters or a short individual denomination are manually entered over the computer in order to retrieve target language results while interpreting. Incorrect entries, which can easily happen under time pressure, should be avoided, even if there is a fuzzy search function (because this can lead to a larger number of results that have to be disambiguated). It seems therefore obvious, that CAI systems require physical keyboards, a relatively large screen (not partially covered by a virtual keyboard, whose operation increases attention sharing and reduces the visibility of relevant data) and fast computing power to display results in real time.

CAI systems should therefore include a dedicated keyboard, reasonable screen size, a fast processor, and a large amount of RAM, as is the case with notebooks or sub-notebooks. CAI systems without these components (e.g. „naked" tablet computers or even smartphones) seem therefore hardly or not at all suitable for the

use of primary CAI tools during the interpreting phase[23]. The fact that some applications (*Flashterm Interpreter*, *Interpretbank* and *Interpreter's Help*) are nevertheless advertised for this hardware can therefore only be explained by commercial interests at best.

9. Prospects

The technical evolution of CAT and CAI (sections 1 and 2) shows that both areas developed in parallel, albeit with a time lag: Innovations were first introduced in CAT and later "discovered" and implemented for CAI. This development is likely to continue and to take place primarily in integrated CAI tools.

It can be assumed therefore, that missing or less developed functions (such as fully automated bilingual term extraction or sophisticated reporting functions for quality assurance or price quotes) will be retrofitted in the future. It can also be expected that an interface for Machine Translation as well as collaborative functions will be generalized. This will probably also be the case for browser-based applications - not least due to the increasing importance of Remote Interpreting (RI) which partially relies on the same technologies. In this regard, it seems even quite conceivable that RI providers such as *Kudo* (kudoway.com) or *Interprefy* (interprefy.com) will actively intervene in the development of CAI tools and establish a new standard, reshaping the interpreter's workplace comparably to what happenend in the translation industry at the beginning of CAT.

Another important driving factor is the enormous progress in the field of artificial intelligence, especially at the level of Automatic Speech Recognition (ASR).

ASR has been used for several years now in speech-to-text interpreting for the hearing impaired (the so-called "respeaking") and is increasingly replacing the use of traditional or special shorthand keyboards. The speech-to-text reporter dictates the discourse (in an interpreting booth or through a sound-absorbing mask, the silencer) using a speech recognition program - f. i. *Dragon Naturally Speaking* (www.nunace.com; Win/IOS/Android; cost-based*)*. A keyboard is only needed for minor corrections. This type of interpreting is also already practiced online. Intralingual and interlingual live subtitling also increasingly rely on ASR.

Other solutions are emerging for simultaneous interpreting. Here, ASR is not used to deliver the final product, but to assist the human interpreter in its production.

Cheung and Tianyin (2019) f.i. describe the successful use of ASR to support simultaneous interpreters when confronted with strong speaker accents.

---

[23] These systems also make little sense (if any) in all other phases of an interpreting assignment. In relation to CPU-intensive tasks (filtering of large locally installed term bases, the use of concordance tools or Automatic Speech Recognition etc.) they are anyway largely undersized. See also section 6.

Wang and Wang (2019) go a step further and suggest the use of automatic transcription and translation in consecutive interpreting, but still see problems with the ergonomics of available MT systems and cognitive load, especially for inexperienced interpreters.

Already at the prototype stage at present is the use of ASR for retrieving target language terms in the interpreting phase. A corresponding function is f.i. part of the integrated CAI tool *Interpretbank 6*.

In order to use the prototype version, *Interpretbank 6* as well as a speech recognition software such as *Dragon Naturally Speaking* must be installed on a PC (in this case a notebook or subnotebook, as the configuration needs a lot of computing power). This CAI system must also be equipped with an audio input (audio line-in)[24]. The audio port than has to be connected to the interpreting console, in order to receive the necessary speech input from discourse. This might be achieved over an additional (or split) audio port of the console. If the speech recognition software is correctly calibrated, a specific window in *Interpretbank 6* will display not only the continuous transcription of discourse, but also, separately, numbers and named entities contained therein. A further data field ("terminology") displays denomination equivalencies, which are automatically extracted from the terminology database based on source language denominations recognized by the tool. Once entirely reliable and ready for use, this functionality could fully automatize step 8 of the phase model of interpreting. It would thus be not necessary anymore to enter search strings manually during the interpreting phase. The corresponding cognitive effort would disappear.

However, in this configuration, speech recognition and matching with the terminology database is a continuous process. So far, it seems to be impossible to trigger the display of target language denominations if a concrete knowledge deficit arises during the reception of discourse. This results in a constantly changing list of data equivalencies on the screen, which makes visual capturing and disambiguation of relevant entries even more challenging.

This is the starting point for a research project currently underway at Carnegie Mellon University in the USA (Vogler, Stewart & Neubig, 2019). The goal is to develop an algorithm that predicts which word in a discourse may not be interpreted. The algorithm should also be able to differentiate whether a specific denomination was left out because it was not relevant or mentally unavailable. In the second case, a suitable target language denomination would be displayed automatically in such a way that it can still be integrated into the human interpretation.

[24] Standard CAI systems (business notebooks or subnotebooks) are normally not equipped with these ports. An external docking-station or sound card would be the adequate solution here.

Conclusion

It follows from the previous sections that CAI can be used in all phases and practically throughout the entire workflow of an interpreting assignment, if one is aware of the limitations and conditions of use.

By definition, secondary CAI tools can be used alongside primary applications (not least because they offer more far reaching options than similar functions with the integrated CAI tools – e. g. bilingual term extraction). However, it seems obvious that integrated solutions offer a superior data handling. In addition, integrated CAI tools (or at least one of them - *Interpretbank*) offer numerous automation aids for repetitive work steps outside the interpreting phase (search of definitions, term extraction, automatic translation, annotation etc.), thus enabling a much more efficient conference preparation than without CAI.

However, it seems important to improve the entry model of all primary and integrated CAI tools as well as its use and visualization during the interpreting phase, although the related ergonomic aspects in particular have not been researched to date. In view of the described upcoming technological developments however, their importance will probably grow. Lastly, a more professional development, the standardization of CAI tools in accordance with scientific findings as well as robust user studies among active interpreters would also be of importance.

As regards the recent and future developments (cf. section 9), the underlying technology is still far from perfect[25]. However, these trends show that it is possible to imagine a purely primary CAI already in the medium term. This would mean a radical change for knowledge management and hence for the way interpreting is organized: Conferences or a specific interpretation would no longer have to be prepared. In a slightly overstated way, one could even say: Interpreters would no longer have to „know everything", but only have to „read everything". This could not only lead to similar working conditions than for translating (screen work - possibly on several screens, combined with a certain degree of post editing of suggestions made by the machine). Pushed a little bit further, this could also have a profound impact on fees, the organization of work and the training of interpreters. The effects on the profession would be noticeable, comparable to what happened in the translation industry after the introduction of translation memories.

If one then also considers the influence of other „disruptive technologies" such as the already mentioned RI, in which all participants need only be connected to each other via computers, the changes the industry is currently heading for become

[25] In addition to the classical problems of screen ergonomics, the necessary structuring of information and attention sharing, ASR, despite the new neural architecture, is still quite error-prone. It struggles f.i. with heavy speaker accents, fast, unarticulated discourse, proper names, homophones or the rapid change of speakers.

apparent. One need not even go so far as to think of the complete replacement of human interpreters by machine interpretation (MI)[26].

But the challenges ahead are great. In addition to the aspects already mentioned, they relate to important questions like data protection, liability, working conditions and, ultimately, the self-image of a profession that will have to reinvent itself in the coming years.

References

Atabekova, A.; Gorbatenko, R.; Shoustikova, T.; Valero-Garcé, C. (2018). Cross-cultural mediation with refugees in emergency settings: ICT use by language service providers. *Journal of Social Studies Education Research*, 2018:9 (3), 351-369.

Barbagianni, C. (2014). *The Use of Traditional Terminology Management Tools for Last-minute Preparation of Interpreting Assignments: An Exploratory Study*. Retrieved December 25 2019 from https://www.researchgate.net/publication/267729146_The_Use_of_Traditional_Terminology_Management_Tools_for_Last-minute_Preparation_of_Interpreting Assignments_An_Exploratory_Study.

Bilgen, B. (2009). *Investigating Terminology Management for Conference Interpreters*. MA dissertation, University of Otawa, Otawa, Canada.

Berber-Irabien, D. 2010. *Information and Communication Technologies in Conference Interpreting*. Doctoral Dissertation. Universitat Rovira I Virgili. Tarragona. Retrieved December 25 2019 from http://www.tdx.cat/bitstream/handle/10803/8775/tesi.pdf?sequence=1.

Carl, M. & Braun, S. (2018). Translation, interpreting and new technologies. In K. Malmkjaer (ed), In: The Routledge Handbook of Translation Studies and Linguistics. London:Routledge, 374-390. Retrieved February 12 2020 from http://epubs.surrey.ac.uk/848944/1/__homes.surrey.ac.uk_home_.System_Desktop_Braun_2017_HandbookTL_with_Carl.pdf.

Cheung, A. & Tianyun, L. (2018). *Automatic speech recognition in simultaneous interpreting: A new approach to computer-aided interpreting*. Retrieved February 9 2020 from https://www.researchgate.net/publication/333457260_Automatic_speech_recognition_in_simultaneous_interpreting_A_new_approach_to_computer-aided_interpreting.

Corpas Pastor, G. (2018). Tools for Interpreters: The Challenges that lie ahead. Current Trends in Translation Teaching and Learning. E, 5, 157 – 182. Retrieved February 10 2020 from http://www.cttl.org/uploads/5/2/4/3/5243866/cttl_e_2018_5.pdf.

Corpas Pastor, G. (2017). *VIP: Voice-Text lntegrated System for Interpreters*. Proceedings of the 39th Conference Translating and the Computer, Geneva, pp. 7-10, 2017. Retrieved January 27 2020 from https: / / www.asling.org/ tc39/?page id=3223.

[26] Which will probably replace professional conference interpreters only if MI will reach the same degree of quality and reliability as its human counterparts. However, this situation seems to lie in the distant future -cf. Downie 2020, p. 4; Fantinuoli 2019, p.12, Setton and Dawrant 2016, p. 593.

Corpas Pastor, G. & Fern, M.L. (2016). *A survey of interpreters' needs and their practices related to language technology*. Technical report. Spain: Malaga, Universidad de Malaga. Retrieved January 25 2020 from https://www.researchgate.net/publication/303685153_A_survey_of_interpreters'_needs_and_practices_related_to_language_technology/link/574d543a08ae061b3301f63d/download.

Costa, H., Corpas Pastor, G. & Duràn Muñes, I. (2014). *Technology-Assisted Interpreting*. Retrieved December 26 2019 from https://www.academia.edu/6926555/Technology-assisted_Interpreting.

Desmet, B., Vandierendock, M. & Defrancq, B. (2018). Simultaneous interpretation of numbers and the impact of technological support. In: C. Fantinuoli (Ed.). 2018. *Interpreting and technology (Translation and Multilingual Natural Language Processing 11)*. Berlin: Language Science Press.

Downie, J. (2020). *Interpreters vs machines. Can Interpreters Survive in an AI-Dominated World?* Routledge, Oxon and New York.

European Commission. (2017). *UK translator survey final report 2017*. Retrieved December 25 2019 from https://ec.europa.eu/unitedkingdom/sites/unitedkingdom/files/ukts2016-final-report-web_-_18_may_2017.pdf.

Fantinuoli, C. (2019). *The technological turn in interpreting: the challenges that lie ahead*. Proceedings of the conference *Übersetzen und Dolmetschen 4.0. - Neue Wege im digitalen Zeitalter* (2019), 334-354. Retrieved December 25 2019 from https://www.staff.uni-mainz.de/fantinuo/ .

Fantinuoli C. & Prandi, B. (2018). Teaching information and communication technologies: a proposal for the interpreting classroom. *trans-kom,* 11(2), 162-182. Retrieved December 25 2019 from https://www.trans-kom.eu/bd11nr02/trans-kom_11_02_02_Fantinouli_Prandi_Teaching. 20181220.pdf.

Fantinuoli, C. (2006). Specialized corpora from the Web and term extraction for simultaneous interpreters. In: M. Baroni and S. Bernardini (Eds.) *Wacky! Working papers on the Web as Corpus*, 173-190. Bologna: GEDIT. Retrieved December 25 2019 from https://www.staff.uni-mainz.de/fantinuo/.

Farwick, J. (2009). *New Technologies and Conference Interpretation*. Proceedings of the Translation Conference held on November 8, 2008 at the University of Portsmouth. pp. 70-79, 2009. Retrieved January 27 2020 from http: / /www.port.ac.uk/ media/ contacts-anddepartments/slas/ events/ tr08-farwick. Pdf .

Garcia, I. (2014). Computer-Aided Translation. In: *The Routledge Encyclopedia of Translation Technology* Routledge. Retrieved January 22 2020 from https://www.routledgehandbooks.com/doi/10.4324/9781315749129.ch3.

Gile, D. (1995). *Basic Concepts and Models for Interpreter and Translator Training*. Amsterdam/Philadelphia: Benjamins.

Goldsmith, J. (2017). *The Interpreter's Toolkit: Intragloss - a useful glossary-building tool for interpreters*. Aiic.net. Retrieved February 22 2020 from http://aiic.net/p/7886.

Kalina, S. (2010). New Technologies and Interpreting Processes. In: H. Lee-Jahnke et al. (Eds.) *Am Schnittpunkt von Philologie und Translationswissenschaft:Festschrift zu Ehren von Martin Forstner*. Bern: Lang, 79-96.

Kalina, S. (2005). Quality assurance for interpreting processes. *Meta* 50(2005)2, 769-784. (Special Edition, Hanne Lee-Janke, Ed.).

Kalina, S. (2002). Quality in interpreting and its prerequisites - A framework for a comprehensive view. In: *Interpreting in the 21st Century*. Proceedings of the 1st

Conference on Interpreting Studies, Forlì, University of Bologna (9-11 November 2000), G. Garzone, and M. Viezzi (Eds). Amsterdam/Philadelphia: Benjamins, 121-130.

Pérez-Pérez, P. (2018). The use of a corpus management tool for the preparation of interpreting assignments: a case study. *The International Journal for Translation & Interpreting Research trans-int.org*. Retrieved February 11, 2020 from https://www.trans-int.org/index.php/transint/article/viewFile/563/311.

Prandi, B. (2017). Designing a Multimethod Study on the Use of CAI Tools during Simultaneous Interpreting. In: Proceedings of *Translating and the Computer 39*. Retrieved January 24 2020 from https://www.asling.org/tc39/wp-content/uploads/TC39-proceedings-final-1Nov-4.20pm.pdf.

Prandi, B. (2014). *L'Uso di Interpretbank nella didattica dell'interpretazione:uno studio esplorative*. Master Thesis. Bologna University. Retrieved January 24 2020 from https://amslaurea.unibo.it/8206/1/prandi_bianca_tesi.pdf.

ProZ.com (2019). *Software Comparison tool*. Retrieved December 25 2019 from https://www.proz.com/software-comparison-tool/cat/cat_tools/2.

Sand, P. (2004). *Manage your terminology with interplex*. Aiic.net. Retrieved January 23 2020 from https://aiic.net/page/1321/manage-your-terminology-with-interplex/lang/1.

SDI München. (2007). *Terminologiewerkzeuge fuer_Dolmetscher*. Retrieved December 25 2019 from https://www.bdue-fachverlag.de/download/mdue/587.

Seeber, K. (2007). *Thinking outside the cube: Modelling language processing tasks in a multiple resource paradigm*. Interspeech 2007, Antwerp, pages 1382-1385. Retrieved February 3 2020 from https://www.researchgate.net/publication/221478894_Thinking_outside_the_cube_Modeling_language_processing_tasks_in_a_multiple_resource_paradigm.

Setton, R. & Dawrant, A. (2016). *Conference Interpreting. A trainer's guide*. Benjamins Amsterdam/Philadelphia.

Stoll, C. (2009). *Jenseits simultanfähiger Terminologiesysteme*. Trier: Wvt Wissenschaftlicher Verlag.

Tabor, J. (2013). *CAT tool use by translators: who is using?* Retrieved January 22 2020 from https://prozcomblog.com/2013/03/22/cat-tool-use-by-translators-who-is-using/.

Verplaetse, H. & Lambrechts, A. (2019). Surveying the use of CAT tools, terminology management systems and corpora amongst professional translators. General state of the art and adoption of corpus support by translator profile. *Parallèles* 31 (2). Retrieved December 25 2019 from https://www.paralleles.unige.ch/files/7715/7151/4604/Paralleles_31-2_2019_Verplaetse-Lambrechts.pdf.

Vogler, N., Stewart, C. & Neubig, G. (2019). Lost in Interpretation: Predicting Untranslated Terminology in Simultaneous Interpretation. Retrieved December 25 2019 from http://arxiv.org/abs/1904.00930.

Wagener, L. (2012). *Vorbereitende Terminologiearbeit im Konferenzdolmetschen unter besonderer Berücksichtigung der Zusammenarbeit im Dolmetschteam*. Master thesis at the University of Applied Sciences Cologne, Faculty of Information and Communication Sciences, Institute for Translation and Multilingual Communication. Retrieved December 25 2019 from https://termcoord.eu/wp-content/uploads/2013/08/Terminologiearbeit-im-Konferenzdolmetschen.pdf.

Wang, X. & Wang, C. (2019). Can Computer-assisted Interpreting Tools Assist Interpreting? *Transletters. International Journal of Translation and Interpreting,* 3, 109–139. Retrieved February 20 2020 from

https://www.researchgate.net/publication/334945514_Can_Computer-assisted_Interpreting_ Tools_Assist_Interpreting.

Will, M. (2015). Zur Eignung simultanfähiger Terminologiesysteme für das Konferenzdolmetschen. *trans-kom* 8 [1] (2015): 179-201. Retrieved December 25 2019 from https://www.trans-kom.eu/bd08nr01/trans-kom_08_01_09_Will_Konferenzdolmetschen.20150717.pdf.

Will, M. (2009). *Dolmetschorientierte Terminologiearbeit. Modell und Methode*. Tübingen: Narr.

Will, M. (2008). Knowledge Management for Simultaneous Interpreters in LSP Conferences. H. Gerzymisch-Arbogast, G. Budin, G. Hofer (Eds.): LSP Translation Scenarios. (*MuTra Journal* 02.) Saarbrücken: ATRC Group, 65-99. Retrieved December 25 2019 from https://euroconferences.info/proceedings/2007_Proceedings/2007_Will_Martin.pdf.

Will, M. (2000): Bemerkungen zum Computereinsatz beim Simultandolmetschen. In: S. Kalina, S. Buhl, H. Gerzymisch-Arbogast, (Eds.): *Dolmetschen: Theorie – Praxis – Didaktik mit ausgewählten Beiträgen der Saarbrücker Symposien*. St. Ingbert: Röhrig. 125-135.