Arabic and Computer-Aided Translation: an integrated approach

Barbara Quaranta – Università degli Studi del Molise

1 Introduction

The general aim of this work is to highlight the problems that translation tools which are not adequately internationalised may cause during translation from or into non-Western languages, such as Arabic.

This paper analyses previous results obtained by an experimental translation of Arabic texts with a translation tool. The first specific objective in this stage was to look for any problems that could arise during translation of an Arabic text using the translation tool called SDL Trados. Two sales contracts in Arabic were translated using the SDL Trados 2007 CAT tool suite.

The other objective was to suggest a solution for problems found during translation with SDL Trados, by providing a specific procedure for the use of CAT tools for the Arabic language.

Drawing from experimental preliminary conclusions, the latest developments in machine translation and corpus-based translation will be analysed, considering different approaches related to language and translation.

The final objective of this paper is to provide a theoretical framework to assess the validity and efficacy of the most recent techniques and technology related to translation. The working hypothesis is that recently-developed tools could contribute to a more adequate internationalisation of software, keeping in mind non-Western languages along with the others. Such methodologies could better address the problems found during translation of Arabic texts with CAT tools.

More specifically, the recent developments in machine translation, as well as corpus-based translation would allow for a more precise and accurate analysis of language and its specific morphology when processing and translating Arabic texts, thus eliminating many of the problems stemming from the specific linguistic features of Arabic.

1.1 Arabic and Computer-Aided Translation

Interest in Arabic is increasing due to current economic and geopolitical events and, even though CAT tools may simplify the translation process, they are not commonly used by translators working with Arabic.

This experimental study addresses to the growing need for storing, computerising and translating a large number of Arabic texts. Accordingly, translators need to comply with the requirements of the translation market, but, since CAT tools were initially developed for Western languages, they are not completely compatible with Arabic.

The preliminary results of an experimental translation of Arabic texts into English are presented together with the procedure that was specifically studied to overcome difficulties due to the specific linguistic and morphological features of the Arabic language.

1.2.1 Arabic and its specific morphological features

Arabic is the most widely spoken Semitic language, the sixth most widely spoken language in the world and one of the six official languages of the United Nations. Arabic speakers have different ethnic backgrounds and different religions. There are different varieties of Arabic, among which there are Modern Standard Arabic, that is the official language, the Classical Arabic of the Qu'ran and the national dialects. Educated Arabic speakers of any nationality can usually understand Modern Standard Arabic despite territorial differences. On the contrary, dialects, which are about 35 and are used for everyday spoken communication, have many differences in pronunciation and lexicon and may be very different from one another, so that two Arabic speakers coming from different countries and speaking their own dialects may not understand each other.

Arabic has its own 28-letter alphabet. Every letter undergoes graphic variations as a consequence of its position that may be independent, at the beginning, in the middle or at the end of a word. Some of the letters have all of the four forms, others, the majority of them, have less than four forms. Some other letters cannot be linked to the following one, even if they are part of the same word.

Arabic is always written from right to left, except for numbers that are written from left to right.

Arabic is a diacritized language: the pronunciation of Arabic words cannot be fully determined by their spelling characters only. It could happen that two different words have identical spelling whereas their pronunciations and meanings are totally different. To remove this ambiguity, special marks are put above or below the spelling characters to determine the correct pronunciation. These marks are called diacritics.

Basically, short vowels are not written inside the words, but above or below the letters they refer to. They are *dammah*, *kasrah* and *fathah*. Arabic mother tongues, however, automatically pronounce the words with their own correct diacritisation, so diacritics are not used in the majority of Modern Standard Arabic texts. It often happens that two or more different words have the same concatenation of consonants, but vary in their pronunciation only based on the different short vowels. However, if diascritisation is not shown, they may create confusion in meaning, especially among non-mother tongues.

Arabic writing does not make a distinction between capital letters and lower-case letters. There is no clear distinction even between cursive and printed letters.

Definitive article, some prepositions, conjunctions and personal pronouns are always linked to the word they refer to thus constituting a unique word.

Punctuation in the Arabic language is not used in the same way it is used in Western languages. There are specific rules for the use of punctuation in Arabic, but they are not widespread even in specific and academic fields. It often happens to find sentences that are extremely complex and long, without punctuation.

1.1.3 The experimental phase

The main objective of the experimental study was to examine translation of Arabic texts using a Computer-Aided-Translation tool, in order to test its functioning with Arabic language and to look for any possible issues.

After carrying out a thorough analysis of the results, an optimisation procedure to provide simple and effective solutions was developed.

A specific CAT tool was chosen for experimental phase: SDL Trados 2007 since it is one of the most widespread and used by institutions worldwide.

SDL Trados functioning is based on the use of databases in which translation units are stored. Translation units consist of a sentence, specifically called *segment*, and its translation into another language. Every couple of segments is stored into a

database called Translation Memory. During translation with SDL Trados, the software analyses every sentence in the text and searches for identical or similar segments inside the translation memory, through fuzzy match search. After that, the application submits the corresponding translation to the translator who can either accept it and automatically write it in the text or refuse it and manually enter another translation. Thanks to SDL Trados, it is also possible to load one or more termbases in which specific terms related to the text's topic are stored. Terms into termbases are searched for and submitted to the translator in the same way segments are into the translation memory. Through fuzzy match options it is possible to carry out concordance search even if words are partially different.

A brief survey carried out among Arabic translators helped highlight the possible issues to be addressed and the kind of texts that could be significant for the study. Two preliminary sales contracts were selected for analysis and experimental translation. The first is a generic sales contract form, while the second one is an actual stipulated preliminary sales contract.

1.3 Results

Outcomes show that there are apparent difficulties with computer aided translation in Arabic. Such difficulties are due to the fact that Arabic is different from other Western languages, such as English.

Two kinds of problems were found during experimental translation. One is related to the formatting differences between Arabic and Western languages including the font type and size and the use of punctuation. The other is related to grammatical features of Arabic, and in particular the use of prefixes, suffixes and infixes that prevent the software from recognising terms. The following issues were found during experimental translation and appear to be significant for the translation process.

SDL Trados segmentation rules are not entirely useful and effective for Arabic language as a consequence of the different use of punctuation. In order to insert correct punctuation into the text to be translated, the use of macros was considered. After a thorough analysis of the texts, some recurring expressions having the same function as punctuation were found. Specific substitution macros were created including punctuation so that segmentation rules could be effective also for Arabic texts.

Symbols (special characters) often used in Arabic texts, usually have the same function as punctuation, but may cause problems in segmentation, since they are not included and recognised in segmentation rules. It is important to consider the number, kind and function of symbols in the texts and, if it is the case, to substitute them with the corresponding punctuation.

The use of special characters and symbols should be carefully assessed and the translator should consider substitution with equivalent punctuation when necessary.

Orthographic variations related to the differences in dialectal forms and simplification of written Arabic may prevent term recognition during translation. The easiest, fastest and most effective solution is the use of an automatic correction tool for the Arabic language. In this case, Microsoft Office Multilingual User Interface Pack was installed.

The diacritisation level is an important issue for term and segment recognition since diacritics are considered to be characters in the same way consonants are. As a consequence, they change the word structure and may hinder recognition since a vocalised word is considered as completely different from the same non-vocalised word. Problems may arise in the case of a non-diacritised text and diacritised translation memories or termbases or vice versa.

In these cases, short vowels may change the word structure in such a way that fuzzy match values in terms of percentage, would work poorly for term recognition. In this stage it's necessary to consider and carefully set an effective rate for fuzzy match.

Diacritisation is not commonly used by mother tongues and is not present in the majority of Arabic texts, except when minimum diacritisation is necessary to solve ambiguity problems mentioned before.

There is no effective solution to this problem, since it depends on the way diacritics are coded by the software, however, it could be possible to create and use non-diacritised translation memories and termbases and insert different vocalised forms if necessary using the Multiple translation options. It may also be useful to decrease the fuzzy match value.

As for the second type of problems, an expert in software programming was asked to develop an Access application. Thanks to this application in Visual Basic SQL language, the translator can automatically add all the possible prefixes to any word inserted into a form. The application automatically creates an Excel

spreadsheet in the two languages considered, with all the possible prefixes of the term that is added to the database. The Excel spreadsheet could be easily converted into an XML format by MultiTerm Convert and the entries could be imported into a MultiTerm termbase. All the terms could be recognised even if they have prefixes. This application was specifically designed and developed according to Arabic grammar and morphology and is the result of the research performed in Egypt, at Cairo University. On the basis of the morphological analysis of the two contracts performed by an Egyptian researcher working for the R.D.I. (Research and Development International), a computer engineering company based in Cairo, the use of prefixes and suffixes was thoroughly analysed and adapted for Computer Assisted Translation.

With regards to the issues related to words having different suffixes (e.g. regular plurals), recognition is partly possible by decreasing the fuzzy match value. However, not all the terms are recognised since the fuzzy match value uses percentage rates, and short words with long suffixes would not be recognisable.

2 Recent developments, resources and technology

2.1 Arabic computational linguistics, machine and corpus-based translation

Arabic computational linguistics has two different sets of goals based on the distinction of whether it is intended for non-Arabic environments or for the Arabic speaking world. On the one hand, computer linguists usually develop tools for English speakers who can't speak Arabic, to support them while learning or working with Arabic. On the other hand, the main aim of computational linguistics for Arabic speaking environments is to transfer knowledge and technology to the Arab World, modernize Arabic language and linguistics and make information retrieval, extraction, summarization and translation available to the Arab user (Farghaly, 2010).

What makes Arabic computational linguistics extremely interesting for term recognition is Computational Arabic Morphology and morphological analysis tools that are used in Machine Translation and that could be extremely useful if integrated into Computer Aided Translation tools both at a Translation Memory and Termbase level.

According to Sawaf (2010), since Arabic is highly morphologically inflected, morpho-syntactic analysis will be extremely useful for translation tools which are developed

for languages that are considered to be extremely complex from the morphological point of view. While morphological analysis has a minor role for languages such as English, it is extremely useful to reduce the vocabulary of languages such as Finnish, Hungarian, Arabic and German that have more morphological complexity.

2.2 Translation tools: toward internationalisation

Thanks to the results obtained, it is possible to identify various issues and challenges to be examined and analysed: together with the need for keyboard layout optimisation and the creation of standard procedures for the use and management of vocalisation, it is also necessary to consider other possibilities and opportunities.

Problems deriving from the morphology of Arabic suggest that CAT tools should include morphological analysis strategies. Even though problems related to the use of prefixes which hinder term recognition may be controlled by external applications, this solution would be far quicker and more useful if it was included in SDL Trados software. As an example, fuzzy match options for the Arabic language should take into account not only suffixes, but also prefixes and infixes.

It would also be useful to sort out a way of implementing morphological analysis software with CAT tools.

The final objective of this study is not only to suggest further research possibilities and opportunities about CAT tools' effectiveness for Arabic, but also to give additional and useful information to enhance software internationalisation.

As Tymoczko pointed out (1998:652-660):

"… we need to know the specifics of different languages in translation, the individual particularities of specific pairings of languages in translation exchanges, and the characteristics of translation as cultural interface at different times and places and under different cultural conditions. […] For a long time in the history of translation theory and practice, difference was perceived in a negative way, as a departure from fidelity, a sign of the loss inherent in the translation process. In very different ways, both Eugene Nida's school of "dynamic equivalence" translation and more recent approaches to translation — from those of Philip Lewis (1985) to the feminist translation theorists (Bassnett 1992, 1993: 7) to the Brazilian school promoting "cannibalism" (Vieira 1994) — have valorized difference in translation. It is clear that CTS [*Corpus Translation Studies*] has the potential to be one means of challenging hegemonic, culture-bound views of texts, translations, and cultural transfer. It is a powerful tool for perceiving difference and for valorizing difference as well." (Tymoczko, 1998 : 652-660).

By observing the differences in languages, it would be possible not only to consider non-Western languages in a correct and respectful way while extending translation strategies which are typically Western in their applications to them, but also to make differences within the European languages more visible in order to stress the importance of specific linguistic features in creating internationalised and effective translation tools.

Barbara Quaranta has a degree in translation and interpretation for specific purposes and an MA in technical and scientific translation in English and Arabic from "S. Pio V" University in Rome. She has
been studying the use of CAT tools with Arabic for four years and, at Cairo University, conducted research on how morphological analysis can help optimize software for computer-aided translation of Arabic. After working as a teacher and translator in Abu Dhabi, she is now a PhD student in intercultural relations and processes at the University of Molise, Italy. Her interests comprise cultural translation, intercultural philosophy, ethnocentrism related to translation methodology and practice.

References

- Attia, M. (2000). *A large-scale computational processor of the Arabic morphology, and applications*. Giza: Cairo University.
- Austermuhl F., (2001). *Electronic Tools for Translators (Translation Practices Explained)*. Manchester: St. Jerome Publishing.
- Baker, M. (1992). *In Other Words: A Coursebook on Translation*. London/New York: Routledge.
- Barber, B. (2000). *Jihad vs. McWorld: Globalization and the Challenges of a New Century: A Reader*. Bloomington, Indiana: Indiana University Press.
- Bell, R. T. (1991). *Translation and Translating: Theory and Practice*. London/New York: Longman.
- Bishop, M. (1998). *How to Build a Successful International Web Site*. Corious Group.
- Bowker, L., M. Cronin, D. Kenny & Pearson eds. (1998). *Unity in diversity? Current trends in translation studies.* Manchester: St. Jerome publishing.
- Buckwalter, T. (2004). "Issues in Arabic Orthography and Morphology Analysis", proceedings of the *Workshop on Computational Approaches to Arabic Script-based Languages*, August 28, 2004. Geneva.
- Campbell, G. (2000). *Compendium of the World's Languages*. New York: Routledge.
- Campbell, G. (1997). *Concise Compendium of the World's Languages*. New York: Routledge.

- Campbell, G. (1997). *Handbook of Scripts and Alphabets.* New York: Routledge.
- Carmel, E. (1999). *Global Software Teams: Collaborating Across Borders and Time Zones*. Upper Saddle River, NJ: Prentice Hall PTR.
- Carrol, S. (2000). "Introducing the TRADOS Workflow Development" in *Translating and the computer 22.* Aslib proceedings.
- Ciola, B., Coluccia, S., Maganzi Giorni D´Angiò, F. & F. Mayer (2000). Atti del Seminario: *Traduzione e computer: le nuove tecnologie nella traduzione assistita.* Bolzano 30 giugno - 1 luglio.
- Ciola B. e F. Mayer a cura di (1999), *Traduzione assistita*, in *Atti del Seminario Terminologia e Traduzione assistita*, AITI Sez. Veneto Trentino-Alto Adige.
- Comrie, B. (1990). *The World's Major Languages*. Oxford: Oxford University Press.
- Comrie, B., S. Matthews, & M. Polinsky, eds. (1996). *The Atlas of Languages: The Origin and Development of Languages throughout the World*. New York: Checkmark Books.
- Daniels, P. T. & W. Bright (eds.). (1996). *The World's Writing Systems*. Oxford: Oxford University Press.
- Daniels, J. L. & N. C. Daniels. (1993). *Global Vision: Building New Models for the Corporation of the Future*. New York: McGraw-Hill.
- Del Galdo, E. & J. Nielsen. (1996). *International User Interfaces*. New York: John Wiley and Sons.
- Dennet, G. (1995). *Translation Memory: Concept, products, impact and prospects.* London: South Bank University.
- De Palma, D.A. (2002). *Business Without Borders: A Strategic Guide to Global Marketing*. New York: John Wiley and Sons.
- Digital Equipment Corporation. (1991). *Digital Guide to Developing International Software*. Digital.
- Dr. International (ed.). (2002). *Developing International Software, 2nd edition*. Redmond, WA: Microsoft Press.
- Eid, M. et. Al. (2006). *Encyclopaedia of Arabic Language and Linguistics.* Boston: Brill.
- Esselink, B. (2000). *A Practical Guide to Localization*, Amsterdam: John Benjamins Publishing Co.
- Erard, M. (2004). "Translation in the age of terror". *Technology Review*, 107: issue 2.
- Farghaly, A. (2010), edited by, Arabic Computational Linguistics, CSLI Studies in Computational Linguistics, CSLI Publications, Stanford, California.
- Fromkin, V. & R. Rodman. (1998). *An Introduction to Language*. Forth Worth: Harcourt College Publishers.
- Gaspari, F. (1999). *The role of MT and MAT for the professional translator.* Forlì: Scuola Superiore di Lingue Moderne per Interpreti e Traduttori.
- Gillam, R. (2002). *Unicode Demystified: A Practical Programmer's Guide to the Encoding Standard*. Boston: Addison Wesley Professional.
- Gotti, M. (1991). *I linguaggi specialistici.* Firenze: La Nuova Italia Editrice.
- Hall, P.A.V. & R. Hudson. (1997). *Software Without Frontiers-A multiplatform, multicultural, multination approach*. New York: John Wiley and Sons.

- Heyn, M. (1998). "Translation Memories: Insights and Prospects" in L. Bowker, M. Cronin, D. Kenny & J. Pearson (1998). 123-136.
- Khan, G. M. (2001). *Arabic Script.* New York: Abbeville Press.
- Hofstede, G. (1997). *Cultures and Organizations : Software of the Mind; Intercultural Cooperation and Its Importance for Survival*. Revised edition. New York: McGraw-Hill.
- Hofstede, G. (1984). *Cultures Consequences: International Differences in Work-Related Values*. Oxford: Paperback Abridged edition.
- Hoft, N. (1995). *International Technical Communication.* New York: John Wiley & Sons.
- Hutchins, J. (2000). *The Early Years of Machine Translation*. Amsterdam, Philadelphia: John Benjamins Publishing Co.
- Hutchins, J. (1998). "The Origins of the Translator's Workstation". *Machine Translation*. 13: 287-305.
- Kano, N. (1995). *Developing International Software*. Redmond: Microsoft Press.
- Karolak, D. W. (1998). *Global Software Development: Managing Virtual Teams and Environment*. New Brunswick: The Computer Society.
- King, M. ed. (1987). *Machine Translation Today: The State of the Art. Proceedings of the Third Lugano Tutorial. 2-7 April 1984.* Edinburgh: Edinburgh University Press.
- Kugler, M., K. Ahmad & G. Thurmair (Eds.) (1995). *Translator's Workbench: Tools and Terminology for Translation and Text Processing.* Berlin: Springer Verlag.
- Ladikoff Guasto, C. (2002). *Ahlan. Grammatica araba didattico-comunicativa.* Roma: Carocci editore.
- Lesina, B., (1998). *Il nuovo manuale di stile*. Bologna: Zanichelli.
- Luong, Tuoc V., S. H. James Lok, D. J. Taylor & K. Driscoll. (1995) *Internationalization - Developing Software for Global Markets*. New York: John Wiley & Sons.
- Macklovitch E. (2000). "Two Types of Translation Memory" in *Translating and the Computer 22.* Aslib proceedings (2000).
- Manca, A. (1999). *Grammatica (teorico-pratica) di arabo letterario moderno,* Associazione nazionale di amicizia e di cooperazione italo-araba. Roma: Anissa.
- Martin O'Donnell, S. (1994). *Programming for the World: A Guide to Internationalization*. N.J.: Prentice Hall.
- Melby, A. (1985). "Machine Translation vs. Translator Aids: A False Dichotomy" in S. Williams (1985). 45-53.
- Melby, A. (1987a). "Creating an Environment for the Translator" in M. King (1987). 124-132.
- Melby, A (1987b). "On human-machine interaction in translation" in S. Nirenburg (1987). 145-154.
- Melby, A. (1992). "The translator workstation" in J. Newton. (1992). 147-165.
- Milo, T. (2002). "Authentic Arabic: A case Study". *20th International Unicode Conference.* Washington, DC.
- Muzii, L. (2001). "Scegliere gli strumenti CAT. Criteri di valutazione" dispensa del *Seminario di introduzione all'uso di strumenti per la traduzione assistita: Déjà Vu, Star Transit e Trados Freelance Edition*.

Roma 10-11 febbraio 2001. A.I.T.I Sezione Lazio.

- Muzii, L. (1995). *La redazione dei documenti tecnici*. Milano: Franco Angeli.
- Newton, J. ed. (1992). *Computers in translation. A practical appraisal.* London: Routledge.
- Nirenburg, S. ed. (1987). *Machine Translation: theoretical and methodological issues.* Cambridge: Cambridge University Press.
- O' Brien, S. (1998). "Practical Experience of Computer-Aided Translation Tools in the Software Localization Industry" in Bowker, L., Cronin M., Kenny, D. & J. Pearson (1998). 115-122.
- Osimo, B. (2004). *Manuale del traduttore.* Milano: Hoepli.
- Osimo, B. (2001). *Traduzione e nuove tecnologie.* Milano: Hoepli.
- Ott, C. (1999). *Global Solutions for Multilingual Applications*. New York: John Wiley & Sons.
- Pinker, S. (2000). *The Language Instinct: How the Mind Creates Language*. New York: Harper Perennial Library.
- Rosen, R. (2000). *Global literacies: Lessons on Business Leadership ond National Cultures: A Landmark Study of CEOs from 28 Countries*. New York: Simon & Schuster.
- Sager, J. C. (1993). *Language Engineering and Translation: Consequences of Automation*. John Benjamins Publishing Co.
- Sager, J.C. (1979). "Multilingual Communication" in B. M. Snell (1979). 1-25.
- Scarpa F. (2001). *La traduzione specializzata*. Milano: Hoepli.
- Schmitt, D. A. (1999). *International Programming for Microsoft Windows: Guidelines for Software Localization with Examples in Microsoft Visual C (Dv-Mps Programming).*Redmond: Microsoft Press.
- Schütz, J. (1998). "Multilingual Human Language Technology in Automotive Documentation Workflows" in *Translating and the computer 20.* Aslib proceedings (1998).
- Snell, B.M. ed. (1979). "Translating and the Computer". *Proceedings of a seminar, London, 14th November, 1978.* Amsterdam: North-Holland.
- Sprung, R. (2000). *Translating into Success*. Amsterdam,Philadelphia: John Benjamins Publishing Co.
- Stonehouse, G., J. Hamill, D. Campbell & T. Purdie. (1998). *Global and Transnational Business: Strategy and Management*. New York: John Wiley & Sons.
- Sobrero A.A. (1993). "Lingue speciali" in A. A. Sobrero (1993). 237-277.
- Sobrero A.A. a cura di (1993). *Introduzione all'italiano contemporaneo. La variazione gli usi.* Roma: Laterza.
- SyNTHEMA (2000). "Progettazione, sviluppo e integrazione di software di Traduzione automatica e Traduzione assistita", dispensa del Convegno internazionale A.I.T.I *Multimedia 2000*, Capomulini (CT) 6-8 giugno 2000.
- Taylor, D. (1992). *Global Software: Developing Applications for the International Market.* Heidelberg: Springer Verlag.
- Traini, R. (1999). *Vocabolario arabo-italiano,* Roma: Istituto per l'Oriente.
- *Translating and the Computer 20.* Papers from the Aslib conference held on 12 & 13 November 1998. London: Aslib.

- Trompenaars, A. & C. Hampden-Turner, F. Trompenaars. (1998). *Riding the Waves of Culture: Understanding Cultural Diversity in Global Business*. Chicago: Irwin Professional Pub.
- Tuthill, B. and D. Smallberg. (1997). *Creating Worldwide Software. (2nd edition)*. Sun Press-Prentice Hall.
- Tymoczko, M., (1998), *Computerized Corpora and the Future of Translation Studies,* in Meta: Translators' Journal, vol. 43, n° 4, 1998.
- Uren, E. et al. (1993). *An Introduction to Software Internationalization and Localization*. New York: Van Nostrand Reinhold.
- van Hoof, B. Keck, R. Mazer, M. Kugler & C. Menzel (1995). "Translation Memory". In M. Kugler, K. Ahmad & G. Thurmair eds. (1995). 83-99.
- Watkins, J. (2001). *The Guide to Translation and Localization: Preparing Products for the Global Marketplace*. Portland, Oregon: Lingo Systems.
- Williams, S. ed. (1982). "Humans and machine", proceedings of the *4th Delaware Symposium on Language Studies, 1982.* Norwood, N.J.: Ablex Pub. Corp.
- Wright, S. E. & G. Budin. (1997/2001). *The Handbook of Terminology Management*. Amsterdam/Philadelphia: John Benjamins Publishing Co .
- Wright, S. E. & R.A. Strehlow. (1995). *Harmonizing Terminology for Translation and Information Retrieval: Theory and Practice, ASTM (STP 1223)*. Philadelphia: ASTM.
- Zawaydeh, B. (1999). *The Phonetics and Phonology of Gutturals in Arabic.* Ph.D. Dissertation. Indiana University.

Webography

- Assénat-Falcone, S. (29/11/2000). *More Translation Memory Tools (not many more, but good ones).* http://www.accurapid.com/journal/12TM.htm
- Assénat-Falcone, S. (29/03/2001). *Translation Aid Software. Four Translation Memory Programs Reviewed.* http://www.accurapid.com/journal/03TM2.htm
- Benis, M. (29.11.00). *Review of Atril´s Déjà Vu 2. The Happy Hoarder.* http://www.accurapid.com/journal/03TM1.htm
- Benis, M. (07/02/2001). *Extended comparative review of Translation Memory products – Part 2.* http://www.transref.org/u-articles/Benis4-BODY.ASP
- Benis, M. (05/12/2000). *Translation Memory From O to R.* http://www.star-ag.ch/press/tm-review01.htm
- Bensch, P. (20/11/2000). *Translation Memories: Übersetzungshelfer mit Gedächtnis.* http://www.doculine.com/news/1999/Oktober/transmem.htm
- Davis, M. (05/06/2008). *UAX #9 Unicode Bidirectional Algorithm.* http://www.unicode.org/reports/tr9/
- Déjà Vu (20/11/2000).http://www.atril.com

- Déjà Vu (20/11/2000). *Déjà Vu / Trados Compatibility Guide.* http://www.atril.com
- Déjà Vu (20/11/2000). *Using Déjà Vu Interactive – a tutorial.* http://www.atril.com
- Eagles (22/02/2001). *Design and function of translation memory.* http://issco-www.unige.ch/projects/ewg96/node152.html
- Erpenbeck, A., Hellman, D., Peters, T., Schmeier, F., Steffens, T., Surrey & J. Wagner (05/11/2000). *Translation Memory.* http://www-lehre.inf.uos.de/~jwagner/tm/node39.html
- Heuberger, A. (05/01/2000). *3 Steps to Successful Translation Management.* http://www.multilingualwebmaster.com/library/3steps.html
- Hoop, M. H. (05/11/2000). *Translation Memories: das elektronische Gedächtnis der Übersetzung.* http://www.doculine.com/news/2000/1000/translationmemories.htm
- Hutchins, J. (07/02/2001). *Computer-based translation systems and tools.* http://www.eamt.org/archive/hutchins.intro.html
- Hutchins, J. (07/02/2001). *Translation Technology and the Translator.* http://www.bcs.org.uk/siggroup/nalatran/nalamtr7/nalamt76.htm
- Islamicawareness.org (11/06/2008).
- Löffler, B. (07/02/2001). *An Introduction to Computer Aided Translation.* http://www.isp.nl/Us/catintrotxt.html
- Löffler, B. (07/02/2001). *Definition of CAT.* http://www.isp.nl/Us/cattxt.html
- Löffler, B. (07/02/2001). *Computer Aided Translation: Main features.* http://www.isp.nl/Us/catmainfeat.html
- Löffler, B. (07/02/2001). *Computer Aided Translation. Translating with a CAT program.* http://www.isp.nl/Us/catTrans.html
- Löffler, B. (07/02/2001). *Computer Aided Translation. When to use a CAT program.* http://www.isp.nl/Us/catwhen.html
- Löffler, B. (07/02/2001). *Computer Aided Translation. Benefits.* http://www.isp.nl/Us/catbenefits.html
- Microsoft. (10/06/2008). *Microsoft Products and Arabic Support.* http://www.microsoft.com/middleeast/arabicdev/
- Multilingual. (10/05/2008). *The Guide from Multilingual. Writing for Translation 2006*. https://www.multilingual.com/downloads/screenSupp83.pdf
- Multilingual. (10/05/2008). *The Guide from Multilingual. The Middle East 2006.* https://www.multilingual.com/downloads/screenSupp81.pdf
- Ray, D.S. & C.J. Ray (07/02/2001). *Good, Fast, Cheap: Translation Memory Systems Offer the Potential for All Three.* http://www.raycomm.com/techwhirl/translationmemory.html
- Saadi, Z. (11/06/2008). *Behind the Name: Etymology of Arabic Names.* http://www.basistech.com/knowledge-center/Arabic/behind-the-arabic-name.pdf

- Salloum, H. (11/06/2008). *The Odyssey of the Arabic Language and its Scripts.* http://www.alhewar.com/habeeb_salloum_arabic_language.htm
- SDL *International e-nabling global business* (16/01/01). http://www.sdlintl.com
- SDL *Termbase* (16/04/2001). http://www.sdlintl.com
- SDL Trados. (18/04/2008). *MultiTerm User Guide – English.* http://www.translationzone.com/en/landing/downloads/multiterm-user-guide-en.asp
- SDL Trados. (18/04/2008). *Quick Reference TRADOS Commands and Menu Items – English.* http://www.translationzone.com/en/landing/downloads/quick-reference-guide-en.asp
- SDL Trados. (18/04/2008). *Translator's Workbench User Guide – English.* http://www.translationzone.com/en/landing/downloads/translators-workbench-guide-en.asp
- SDL Trados. (18/04/2008). *WinAlign User Guide – English.* http://www.translationzone.com/en/landing/downloads/winalign-guide-en.asp?
- Smiraglio D. (10/10/2006). *Una proposta per un corretto utilizzo di TRADOS.* http://terminologia.sslmit.unibo.it/guida_trados/
- STAR. Software Translation Artwork Recording. (29/01/2000). http://www.star-group.net
- Trados. *The Language Architects* (15/11/2000). http://www.trados.com
- Zawaydeh, B. (10/06/2008). *A Profile of Arabic Script Languages.* http://www.basistech.com/knowledge-center/Arabic/arabic-script-languages.pdf
- Zawaydeh, B. and Z. Saadi. (10/06/2008). *Orthographic Variations in Arabic Corpora.* http://www.basistech.com/knowledge-center/Arabic/orthographic-variations-in-arabic.pdf