Language resources used in multi-lingual question-answering systems

María-Dolores Olvera-Lobo
Department of Library and Information Science, CSIC, Unidad Asociada Grupo SCImago, Madrid, Spain and Universidad de Granada, Granada, Spain, and

Juncal Gutierrez-Artacho
Department of Translation and Interpreting, Universidad de Granada, Granada, Spain

Refereed article received
24 April 2010
Approved for publication
13 October 2010

Abstract

Purpose – In the field of information retrieval, some multi-lingual tools are being created to help the users to overcome the language barriers. Nevertheless, these tools are not developed completely and it is necessary to investigate more for their improvement and application. One of their main problems is the choice of the linguistic resources to offer better coverage and to solve the translation problems in the context of the multi-lingual information retrieval. This paper aims to address this issue.

Design/methodology/approach – This research is focused on the analysis of resources used by the multi-lingual question-answering systems, which respond to users' queries with short answers, rather than just offering a list of documents related to the search. An analysis of the main publications about the multi-lingual QA systems was carried out, with the aim of identifying the typology, the advantages and disadvantages, and the real use and trend of each of the linguistic resources and tools used in this new kind of system.

Findings – Five of the resources most used in the cross-languages QA systems were identified and studied: databases, dictionaries, corpora, ontologies and thesauri. The three most popular traditional resources (automatic translators, dictionaries, and corpora) are gradually leaving a widening gap for others – such as ontologies and the free encyclopaedia Wikipedia.

Originality/value – The perspective offered by the translation discipline can improve the effectiveness of QA systems.

Keywords Information retrieval, Languages, Software tools, Information systems, Databases, Dictionaries, Thesauri

Paper type Research paper

Introduction

In the field of information retrieval (hereafter IR) monolingual and multi-lingual tools are being created that can greatly assist specialists in their work; as well as helping other users find a wide variety of information. Multi-lingual tools are evolving but several years of study and research are still needed to improve implementations. One of the main difficulties facing these tools is the task of translating queries made by users and the documentary sources found in response (Diekema, 2003). Given the current expansion in research, development, and the creation of multi-lingual IR systems, it was considered worthwhile analysing and evaluating the resources used by one type of these systems: multi-lingual question answering systems (hereafter QA systems).

Online Information Review
Vol. 35 No. 4, 2011
pp. 543-557

1468-4527
DOI 10.1108/14684521111161927

Although research in this area began just over a decade ago, QA systems remain largely unknown outside the field of IR. In this context, a study from the perspective of translation may offer a different focus on the problem of translation and resources. Researchers currently working in the field of multi-lingual QA systems are searching for new methods to optimize the efficiency of IR without using too many resources for language problems. These multi-lingual tools are being created to help the users to overcome the language barriers. Nevertheless, these tools are not developed completely and it is necessary to investigate more for their improvement and application. One of their main problems is the choice of the linguistic resources to offer better coverage and to solve the translation problems in the context of the multi-lingual information retrieval.

A multi-lingual QA system cannot easily retrieve relevant information for the user without an optimal solution for translation resources. For this reason, translation is crucial in this environment and enables problems to be analyzed from a fresh point of view. Any progress made in solving problems of multi-lingual communication can be added to existing information retrieval systems.

The basic premises that have guided this study were:

- the use of QA systems enables research in multiple languages, provides faster responses, and increases the likelihood of the user obtaining the right answer;
- the multi-lingual QA systems try to overcome the language barrier, which is one of the most maxim in the IR field; and
- the linguistic tools that most affect efficiency in the field of multi-lingual QA systems must be identified.

This paper is primarily intended as a general purpose analysis and aims to encompass translation in the study of multi-lingual QA systems. The second general aim is to identify and analyze the linguistic resources and tools found in these systems. Specific objectives include identifying the main types of language resources and tools useful in the multi-lingual IR processes associated with multi-lingual QA systems, and establishing how much use is made of these tools by multi-lingual QA systems.

State of the art about the question answering systems

Recent advances in IR and web globalization mean that multi-lingual search systems have been developed in which translation and language resources are as important as the documentary and computer tools. This type of system has opened a new research field that examines the most effective methods for IR, as well as studying which resources are required for a correct translation.

Information overload is felt more strongly on the web than elsewhere. All too often a query made with a web search tool (search engine, meta-search engine) results in the retrieval of too many pages – many of which are useless or irrelevant to the user. Therefore, professionals from various areas are beginning to recognize the usefulness of other types of systems, such as QA systems, for quickly and effectively finding specialist information (Crouch *et al.*, 2005, Lee *et al.*, 2006).

Traditionally, IR is understood as a fully automatic process that responds to a user query by examining a collection of documents and returning a sorted document list that should be relevant to the user requirements as expressed in the query. An optimal IR system recovers all the relevant documents (implying an exhaustive search, i.e. a

high recall) and only the relevant documents (implying perfect accuracy, that is to say, a high precision). This traditional model involves many implied restrictions:

- the assumption that users want full-text documents, rather than answers, and that the query will satisfied with these documents;
- that the process is direct and unidirectional rather than interactive; and
- that the query and document share the same language.

Multi-lingual IR or CLIR (cross-lingual information retrieval) involves at least two languages in this process. Traditionally, CLIR is described like the problem to offer documents for users which they can read (Oard and Gonzalo, 2001). However, it is not only. In a multi-lingual environment such as the web, most IR systems (search engines) are limited to finding documents in the language of the query; or alternatively, include machine translation systems, which are only useful once the documents are located and do not effectively cross the language barrier. QA systems are an evolutionary improvement in IR systems. As an alternative to traditional IR systems they give correct and understandable answers to factual questions – rather than just offering a list of documents related to the search (Jackson and Schilder, 2005). The benefit is that users do not have to read whole documents to find the desired information. QA systems have attracted major attention since the TREC-8 (Text Retrieval Conference) on information retrieval (Voorhees, 1999). TREC conferences have been the major forum for sharing and encouraging international research in information retrieval since 1992.

QA systems are based on short-answer models (Blair-Goldensohn, 2004) that divide the question by assigning to the keyword a label that indicates the type of questions that can be answered. The system replaces this label with the right words to give users a selection of texts that respond correctly to the query (Perez-Coutiño *et al*, 2004). The main advantage is that the user does not have to read the documents to find the required information because the system provides the correct answer in the form of a number, a noun, a short phrase, or a brief piece of text.

Although there are various templates for making queries in QA systems, most of these systems understand questions expressed with interrogative particles (who, what, where, why, when, and how); while some understand the imperative form (tell me). When a query is entered into the interface, the system proceeds to analyze the question by separating the word or keywords. The system then locates and extracts one or several answers from different sources of information, depending on the specialist area of the question (Olvera-Lobo and Gutierrez-Artacho, 2010). Subsequently, the system evaluates and eliminates redundant information, or information that does not respond correctly to the question, and submits one or more prepared responses to the user (Cui *et al.*, 2004; Tsur, 2003).

These systems usually have a simple interface where users can enter their queries, while some offer a list of recent queries to help users understand how the system works. QA systems handle these queries by applying algorithms and methods of linguistic analysis; as well as using natural language processing to identify the components and determine the expected response (Zweigenbaum, 2005). This analysis usually uses a variety of standard questions in which certain words are replaced by labels accepted by the system.

QA systems may be general domain and so answer questions from diverse fields in the same way START or NSIR (see Figure 1). Alternatively, they may be domain-specific and focus on a specialized area, in the same way as MedQA (Frank *et al.*, 2006). Domain-specific systems use specific linguistic resources that enable more precise answers to be given (see Figure 2).

Another key aspect of these systems is that the system-user relationship is two-way. Establishing an interaction helps QA systems find better answers, and in turn, the QA system helps users find answers more quickly. However, it remains necessary to deepen the interactive design of these systems and enable true feedback between questions and answers, so that users communicate with the system in a conversational manner.

While the development of QA systems represents progress, the systems nevertheless suffer restrictions. Many were only developed as prototypes, or demonstration versions, and few were marketed. Some researchers have designed and created systems that were presented and discussed at various forums and conferences. However, because the usefulness of the systems was limited to very specific contexts, or because of problems of implementation, only a few of these systems were later developed for end users.

These circumstances have fuelled academic interest in cross-lingual IR, or CLIR, and the techniques of natural language processing. This interest led to many conferences dealing exclusively, or partially, with CLIR – such as TREC, the Cross-Language Evaluation Forum (CLEF), the NII Text Collection for IR Systems (NTSIR), the Language Resources and Evaluation Conference (LREC), among others. However, research on CLIR, which mostly began in 1996, has not led to commercial success and so dissemination was limited.

Given a particular query, CLIR systems run on a collection of multi-lingual documents and retrieve relevant information regardless of the language used in the query (Grefenstette, 1998). Within the area of multi-lingual IR, the object of our study is multi-lingual QA systems and these systems are opening a new field of research that is becoming increasingly important within CLIR. In multi-lingual QA systems, the language of the question may differ from the language of the retrieved document. However, QA systems differ from other CLIR systems because they do not retrieve whole documents and instead respond to queries with a short answer. According to Aceves Pérez (2008), QA systems are a set of coordinated monolingual systems in which each extracts responses from a collection of separate monolingual documents. Normally, multi-lingual QA systems are similar to monolingual QA systems, the main difference being the incorporation of a translation module and/or linguistic tool for cross-lingual recovery (Figure 3). Most systems tackle the cross-lingual problem by translating the question or query posed in the source language in the target language, and then use a QA system developed for the target language for retrieving an answer (Bos and Nissim, 2006).

Multi-lingual QA systems have emerged as a complementary research task, representing a promising direction for at least two reasons. First, it allowed users to interact with machines in their native languages, contributing to easier, faster, and more equal information access. Second, multi-lingual capabilities enabled QA systems to access information stored only in language-specific text collections (Table I; Forner *et al.*, 2010).

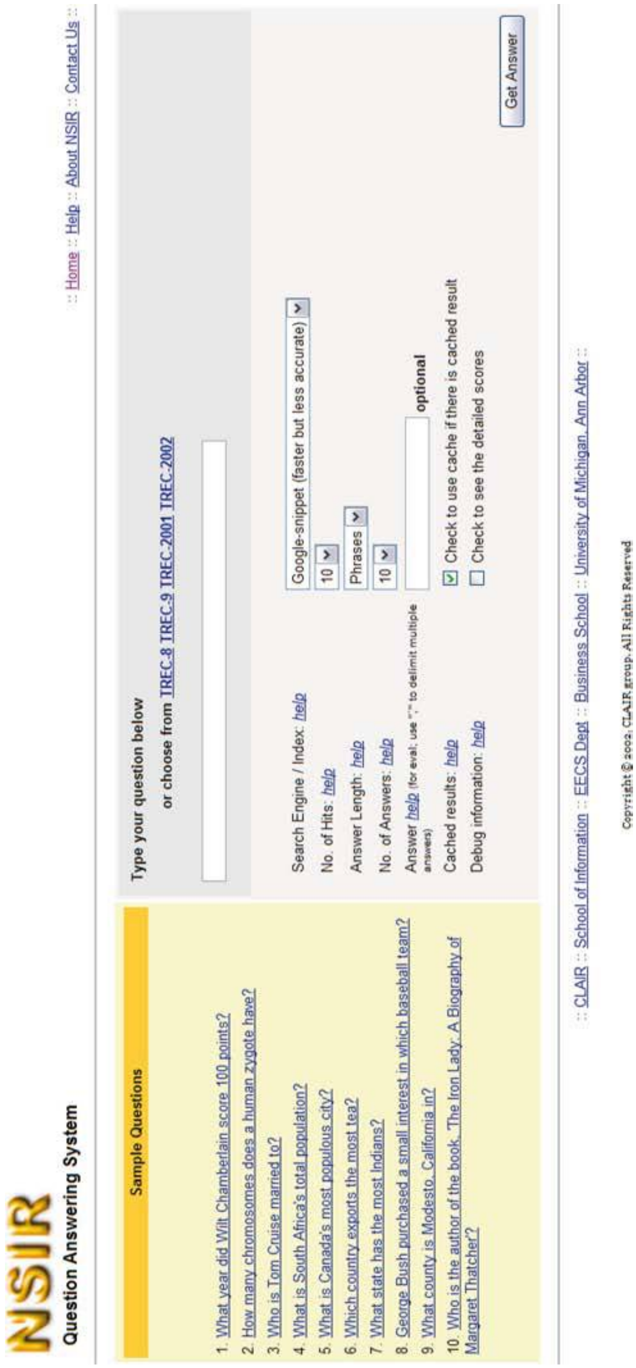
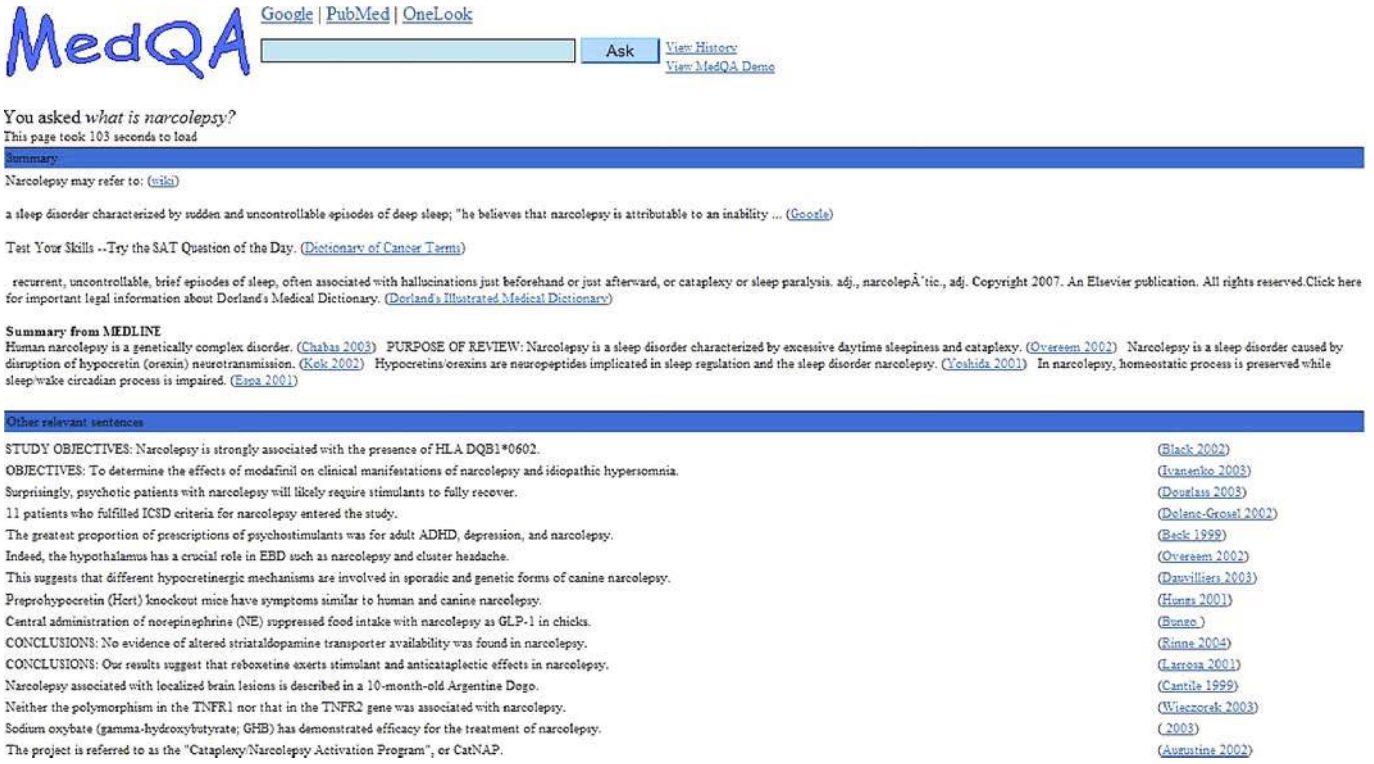


Figure 1.
NSIR answer search interface

Figure 2.
Answers provided by MedQA to the query: What is narcolepsy?



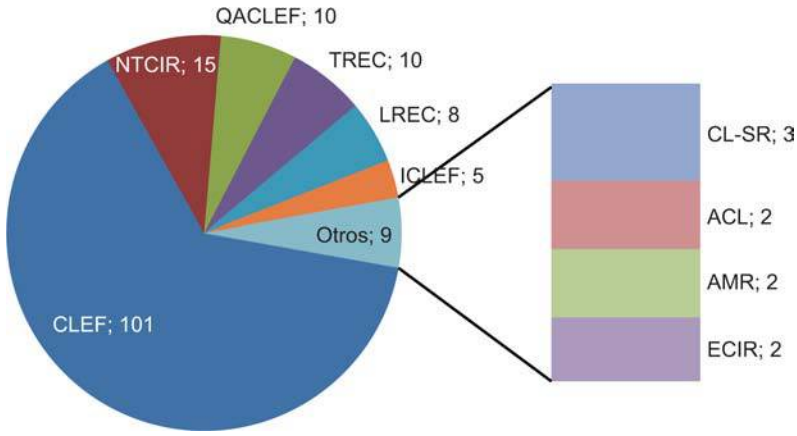


Figure 3.
Papers analyzed by conference

QA system	Web page
ACQUILEX	www.cl.cam.ac.uk/research/nl/acquilex/
AnswerBus	www.answerbus.com/index.shtml
DFKI – multi-lingual web question-answering system	experimental-quetal.dfki.de/
HonQA	http://services.hon.ch/cgi-bin/QA10/qa.pl
Inferret	http://asked.jp/edw/pc/
Mulinex	http://mulinex.dfki.de
QALL-ME	http://qallme.fbk.eu/index.php?location = home
Website term browser	http://nlp.uned.es/wtb/uned/query-uned.html

Table I.
List of the most important multi-lingual QA systems

Translation is crucial in CLIR because queries and documents do not always share the same language. The main translation problems identified are: lexical ambiguity, lack of translation coverage, multi-modal lexemes, and errors in lexical resources (Diekema, 2003). However, translation aspects have been relatively neglected during the development of these systems. Most of the work in this field has been carried out by artificial intelligence and computer specialists, so that the above problems have not been given priority.

Method section

A semi-empirical methodology was adopted for this study and the collection of data about the tools and linguistic resources employed by these systems; as well as their use and implementation.

The first stage of the study focused on identifying the major conferences, meetings, and forums that address multi-lingual QA systems. The aim was to find, analyze, and compare the different types of linguistic resources. Although a growing number of IR conference are held each year, not all include a section devoted exclusively to QA systems, and even fewer tackle multi-lingual aspects. However, we identified several

conferences and forums that mainly focus on research into multi-lingual QA systems. The most important is CLEF (see Figure 4). This European conference was first held in 2000, when interest in the multi-lingual aspects of IR began to grow.

Papers presented at TREC were also monitored to carry out this analysis. Although TREC is centred on retrieval techniques in English, it also covers other languages and each conference features an interesting area devoted to multi-lingual retrieval. TREC was the first conference to address the issue of information retrieval and has been held annually since 1992. NTCIR was the third conference we reviewed and is dedicated exclusively to IR. This conference is mainly focussed on Asian languages (Japanese, Chinese, and Korean), while accepting multi-lingual research on other language pairs. Our study also included other papers dealing with language resources and describing work presented at conferences that have either only been active for a few years, or are not dedicated exclusively to IR – such are LREC. *Some* important studies presented in other journals were also analyzed; together with the few PhD dissertations addressing linguistic tools and resources in multi-lingual QA systems.

In total, some 165 papers published between 2000 and 2008 at the above, and other, conferences were reviewed. No papers from 2009 were included because some of the conferences that were held are yet to publish their proceedings. Over 75 percent of the published articles were presented at CLEF. NTCIR had the second highest number of analyzed articles, and TREC was in fourth place (see Figure 3).

For the studied period, the years with the largest number of papers published on multi-lingual QA systems were 2005 and 2008. A growing level of interest peaked in 2008; and from 2007 interest began shifting to other types of QA systems such as image, voice, and expertise domains (see Figure 5).

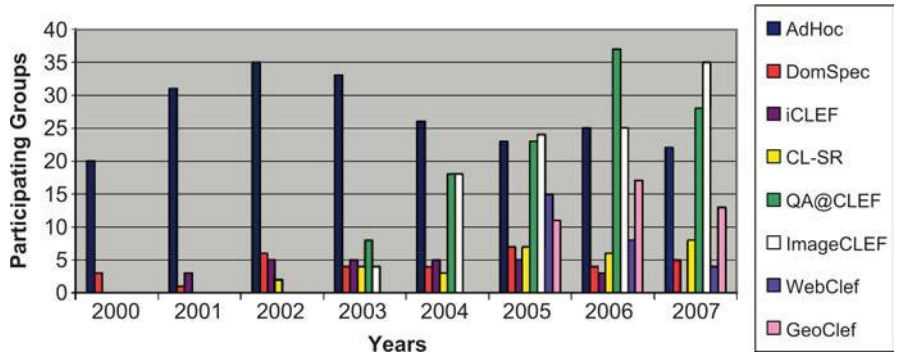


Figure 4.
Groups participating in each of the subject areas of CLEF

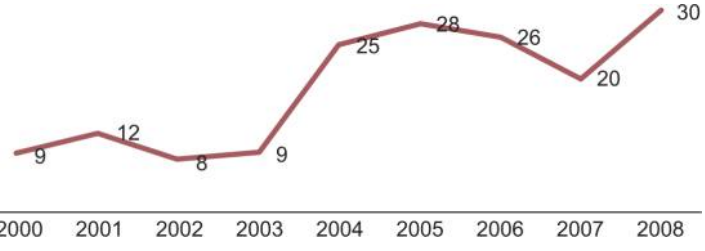


Figure 5.
Papers analyzed by year

We studied the subject discussed in each paper – including the language resources and tools used. Although all the papers discussed the linguistic aspects of multi-lingual QA systems, only some tackled this as the main theme.

In a second phase we explored the resources used by existing multi-lingual QA systems. For some systems, it was relatively easy to obtain information because the linguistic resources were freely accessible and developers provided all the relevant literature. However, these were the exceptions. Most of the systems were partially developed prototypes and access was not available. For this reason, the documentary observation phase of our study was so important because it enabled us to monitor the progress made by these developers.

Results and discussion

Five main types of linguistic resources used in multi-lingual QA systems were identified following an analysis of the literature. The main resource types were databases, corpora, dictionaries, ontologies, and thesauri.

There were also two types of linguistic tools used by these systems, namely, automatic translators and computational grammars. These resources and tools, along with their various types and subtypes, do not run in the same way and use differing methods of processing information. Other methods for solving the problems of cross lingual communication were also used – such as translation and transliteration – and these tools play an important role in several of the systems. Sometimes, a single resource was insufficient and several resources were used together to achieve better results.

Previous works (Diekema, 2003) identified four major sources of translation in CLIR – ontologies, bilingual dictionaries, automatic translators, and corpora (see Figure 6). This study shows that CLIR has grown in popularity in recent years and that some resources are often used. Following an analysis of the literature and after identifying the resources and tools used by multi-lingual QA systems, a classification was made dividing these resources into two large groups: linguistic resources and linguistic tools.

Recent research and advances made in multi-lingual QA systems relate mainly to the more effective incorporation of new language resources, the creation of faster and more efficient systems, and the production of more transparent results. However, there remains an unsolved challenge: translation.

In analyzing the literature, it was found that the resource most used by multi-lingual QA systems was automatic translation, followed by corpora (mostly parallel), and dictionaries (see Figure 7). These results confirm the findings of Nguyen *et al.* (2009).

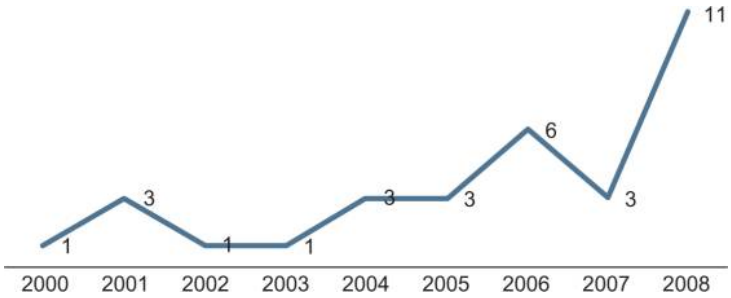


Figure 6.
Use of corpora per year

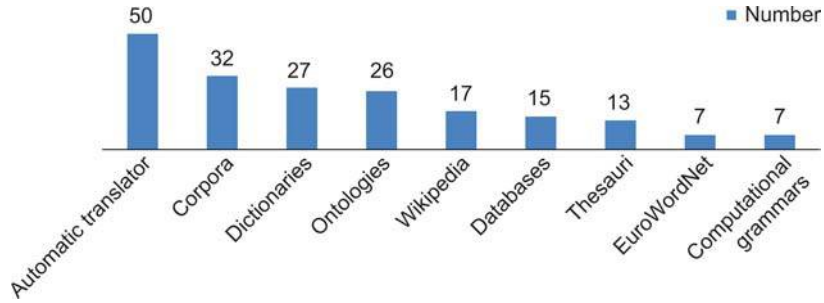


Figure 7.
Resources used in the papers reviewed

Automatic translators were used in 50 of the 165 papers reviewed. This tool is often incorporated individually or in combination with other linguistic resources to offer better coverage. Although most authors confirm the problems of ambiguity and the poor quality of texts, they continue to prefer this tool because it is one of the cheapest and easiest to incorporate into systems. Automatic translation usually gives better results in general domain QA systems than in specific domains. This is because automatic translators cannot identify and correctly translate certain specialized terms. Nor can this tool be recommended for systems that use non-Western languages, or more than two languages. In fact, few automatic translators are effective in these tasks.

However, the use of automatic translators has declined in recent years (see Figure 8). They were used in seven out of nine papers reviewed in the year shown in the figure. However, their presence declines substantially over the next three years (2001, 2002, and 2003). The number of multi-lingual QA systems using automatic translation rose again after 2006, yet not individually as in earlier years, but in combination or in support of other language resources. Automatic translators have continued to be used in the most recent years – but in a smaller number of systems.

The second most commonly used resource is the corpus with 32 occurrences. The apparent popularity of corpora is explained by the fact that many variants of corpora are included within the heading. The most surprising aspect of this resource was its nearly steady growth in recent years and the peak in 2008 – when corpora appeared in 11 of the 30 papers reviewed (Figure 6). We saw a significant decline in use in 2007, but this may be partially attributed to the fact that only 20 papers on multi-lingual QA systems were found for the year.

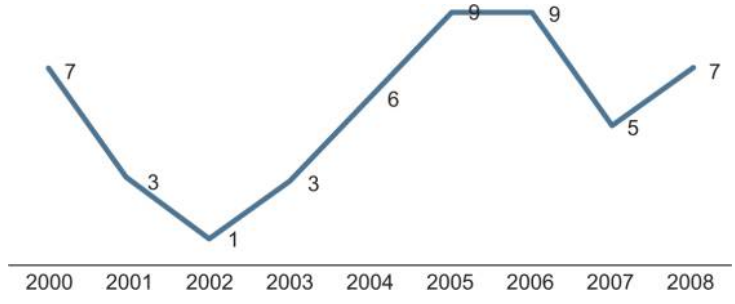


Figure 8.
Use of automatic translators per year

Linguistic corpora are very useful resources for specialized domains. This is because the information received by users will be complete and correct when a translation is made or reviewed by professional translators. Existing corpora can be made available on the web in several languages, so solving two of the main problems raised earlier: computational cost and storage.

The third and fourth most commonly used resources are dictionaries and ontologies, with 27 and 26 appearances respectively. Dictionaries, together with automatic translators and corpora, are the resources traditionally used by these systems, and so a similar trend is found for all three resources. However, grammar and ambiguity problems have recently reduced their popularity, so that only 5 of the 79 systems studied over the past four years used this resource.

Very different behavior is seen with the fifth application – ontologies (see Figure 9). This resource was not used in the early years, but from the year 2004 has begun to slowly gain acceptance in multi-lingual QA systems. Ontologies offer many advantages and especially in specialized domain systems (Figure 10). Most systems are composed of texts that have been completely translated into various working languages, and so relationships are easily established. Another advantage is that there are many research teams working closely with multi-lingual ontologies and studying the various relationships that can be made between terms – and this existing body of work ensures a quality final product.

Wikipedia was used on 17 occasions. This is one of the most innovative resources and is growing rapidly in popularity. It was first incorporated in 2005, and its presence grew substantially the following year. The use of databases, which were used as often as Wikipedia, was very irregular – being entirely absent during some years. The results obtained by incorporating Wikipedia into such systems are unclear; some

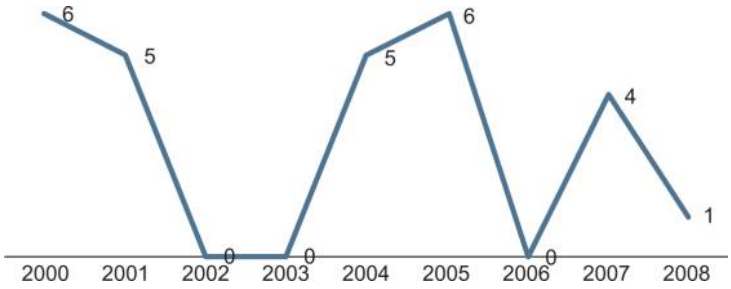


Figure 9.
Use of dictionaries per year

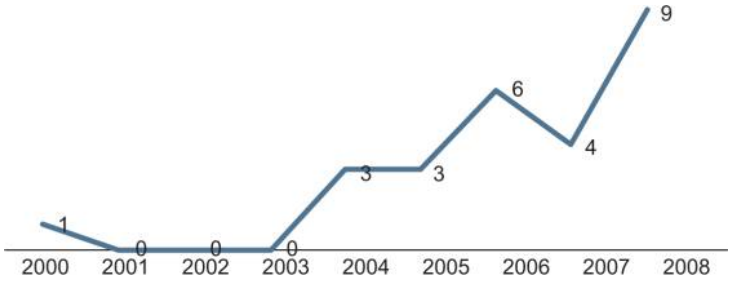


Figure 10.
Use of ontologies per year

researchers claim it is one of the most useful resources, while others stress that there are many errors that are difficult to resolve.

Thesauri were used 13 times. The use of this resource was very limited and irregular – despite a peak in 2004 with six incorporations. This is surprising given that the architecture of thesauri makes them one of the most suitable resources for these systems; although when used alone they do not offer very good results. However, this may change when specialist domain multi-lingual QA systems are developed because many well established thesauri exist on a wide range of topics. The final resource analyzed was the EuroWordNet and computational grammars – and they were used a total of seven times.

The type of translation performed by each of the systems was also analyzed (see Figure 11). The most popular option was the translation of queries, and this is because this is often the most convenient for the system and therefore cheaper. However, the disadvantages and problems of ambiguity do not mean that it is the most appropriate option. The second most popular option was document translation – and this indicates a trend towards quality. We believe that the combination of these first two options is the most appropriate approach because the problems of ambiguity caused by nouns and homonyms are reduced. It is worth noting that QA translation has slightly grown in popularity – although it must be stressed that this is because QA is a relatively new option. However, we believe that the translation of keywords and answers causes the same problems as the translation of queries, and this involves a series of computational costs that could be invested in solving the language problem.

Conclusion

This study has analyzed the main publications over the past nine years – from 2000 to 2008. Literature from 2009 was not included because it was insufficient and did not include real data regarding the situation. In total, 165 papers presented at major conferences (CLEF, TREC, NTSIR) were studied and as much data as possible was extracted for an overview of the situation.

Five of most used resources were identified and studied: databases, dictionaries, corpora, ontologies and thesauri. The final two resources were included in the same group as they referred to specific resources (Wikipedia and EuroWordNet) that were described by the researchers using them as either thesauri or ontologies. The second

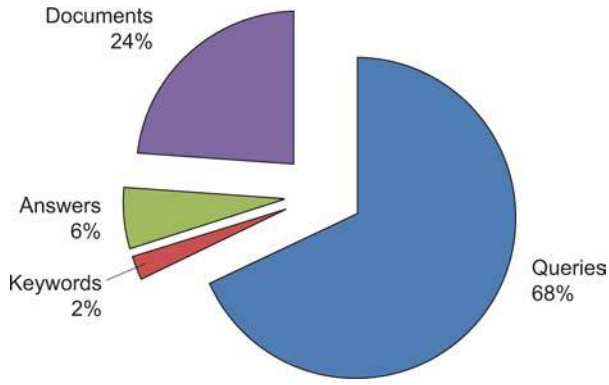


Figure 11.
Type of translation used by the multi-lingual QA systems

group in our study consisted of two linguistic tools: computational grammars and automatic translators. The inclusion of grammars in multi-lingual QA systems is relatively recent, and so the above classifications have not been taken into account. Finally, we studied the various other types of translation used by researchers and some new approaches such as transliteration and compensation translation.

After defining and describing these resources and tools, we considered each of the systems and techniques presented in the 165 papers. We found that automatic translators remain the most popular option, despite the fact that the authors of the papers recognize the resulting problems of ambiguity (see Figure 12). It is the low computational cost and ease of storage that accounts for the popularity of automatic translation among developers. In our opinion, this tool can be adequate for IR when combined with other resources. However, there have been some changes in the use and incorporation of these resources and tools. The three most popular traditional resources (automatic translators, dictionaries, and corpora) are gradually leaving a widening gap for others – such as ontologies and the free encyclopaedia Wikipedia. In addition, other approaches such as computational grammars are slowly attracting more researchers who are experienced in handling the results they produce. This data suggests that we may see unexpected changes in the future and this area deserves to be studied and evaluated in future research.

A comparison of the evolution and use of different resources and tools shows that trends favour the traditionally more popular tools (automatic translators, dictionaries and corpora). However, ontologies and Wikipedia show trends that match, or nearly match, the traditional resources. The remaining tools are timidly growing in popularity and have promising futures. However, the trends for each combination of tools in multi-lingual QA systems were not studied exhaustively.

There is a growing trend toward the translation of documents, although the option to translate queries remains the most widely used by researchers. We believe the combination of both approaches is the most useful route and offers the best results – even handling more than two languages without difficulty.

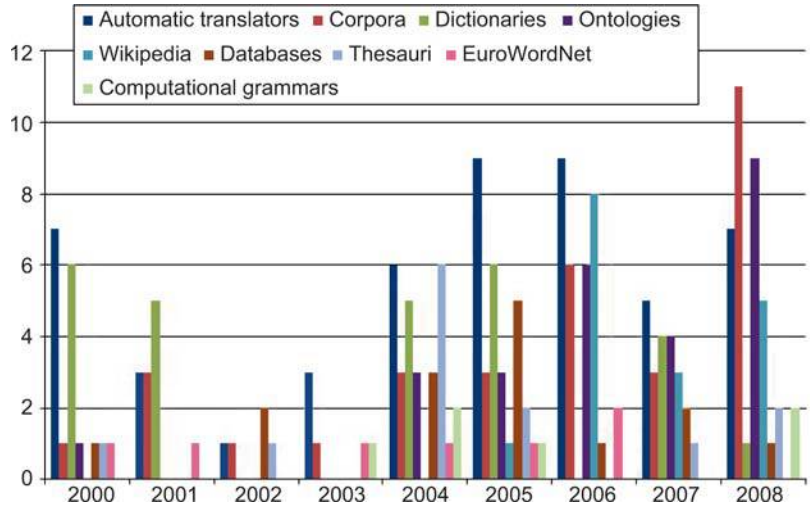


Figure 12.
Resources and tools per year

References

Aceves Pérez, R.M. (2008), "Búsqueda de Respuestas en Fuentes Documentales Multilingües", Dissertation, Instituto Nacional de Astrofísica, Óptica y Electrónica, Tonantzintla.

Blair-Goldensohn, S., McKeown, K. and Schlaikjer, A.H. (2004), "Answering definitional questions: a hybrid approach", *New Directions in Question Answering*, Vol. 4, pp. 47-58.

Bos, J. and Nissim, M. (2006), in Peters, C. (Ed.), "Cross-lingual question answering by answer translation", Working Notes for the Cross Language Evaluation Forum (CLEF) 2006, Alicante, 20-22 September.

Crouch, D., Saurí, R. and Fowler, A. (2005) "AQUAINT pilot knowledge-based evaluation: annotation guidelines", Palo Alto Research Center, available at: www2.parc.com/isl/groups/nltt/papers/aquaint_kb_pilot_evaluation_guide.pdf

Cui, H., Kan, M.Y., Chua, T.S. and Xiao, J. (2004), "A comparative study on sentence retrieval for definitional question answering", paper presented at the SIGIR Workshop on Information Retrieval for Question Answering (IR4QA), Sheffield.

Diekema, A.R. (2003), "Translation events in cross-language information retrieval: lexical ambiguity, lexical holes, vocabulary mismatch, and correct translations", dissertation, University of Syracuse, Syracuse, NY.

Forner, P., Giampiccolo, D., Magnini, B., Peñas, A., Rodrigo, A. and Sutcliffe, R. (2010), "Evaluating multilingual question answering systems at CLEF", *Proceedings of the LREC 2010, Malta, 22-23 May*.

Frank, A., Kirefer, H.U., Xu, F., Uszkoreit, H., Crysmann, B., Jörg, B. and Shäfer, U. (2006), "Question answering from structured knowledge sources", *Journal of Applied Logic*, special issue on Questions and Answers: Theoretical and Applied Perspectives, Vol. 5, pp. 20-48.

Grefenstette, G. (1998), *Cross-Language Information Retrieval*, Vol. 1, Kluwer Academic Publishers, London.

Jackson, P. and Schilder, F. (2005), "Natural language processing: overview", in Brown, E. (Ed.), *Encyclopedia of Language & Linguistics*, Vol. 2, Elsevier Press, Amsterdam, pp. 503-18.

Lee, M., Cimino, J., Zhu, H.R., Sable, C., Shanker, V., Ely, J. and Yu, H. (2006), "Beyond information retrieval – medical question answering", AMIA, Washington DC, 11 October.

Nguyen, D., Overwijk, A., Hauff, C., Trieschnigg, D.R.B., Hiemstra, D. and de Jong, F.M.G. (2009), "WikiTranslate: query translation for cross-lingual information retrieval using only Wikipedia", in Peters, C. *et al.* (Eds), *CLEF 2008, LNCS 5706*, Springer-Verlag, Berlin, pp. 58-65.

Oard, D. and Gonzalo, J. (2001), *The CLEF 2001 Interactive Track. Evaluation of Cross-Language Information Systems*, Springer-Verlag, Berlin.

Olvera-Lobo, M.D. and Gutierrez-Artacho, J. (2010), "Question-answering systems as efficient sources of terminological information: evaluation", *Health Information and Library Journal*, Vol. 27 No. 1, pp. 2-10.

Pérez-Coutiño, M., Solorio, T., Montes y Gómez, M., López López, A. and Villaseñor Pineda, L. (2004), "The use of lexical context in question answering for Spanish", paper presented at Workshop of the Cross-Language Evaluation Forum, CLEF 2004, Bath, UK, September 15-17.

Tsur, O. (2003), "Definitional question-answering using trainable text classifiers", dissertation, University of Amsterdam, Amsterdam.

Voorhees, E.M. (1999), "The TREC 8 question answering track report", in Voorhees, E.M. and Harman, D. (Eds), *Proceedings of the 8th Text REtrieval Conference, Gaithersburg, MD, November 17-19*, pp. 107-30.

Zweigenbaum, P. (2005), "Question answering in biomedicine", in De Rijke, M. and Webber, B. (Eds), *Proceedings of Workshop on Natural Language Processing for Question Answering, EACL 2003, ACL, Budapest*, pp. 1-4.

About the authors

María-Dolores Olvera-Lobo teaches Library and Information Science at the University of Granada (Spain). Her scholarly books and articles have concentrated on Retrieval Information, Information Science and Translation Teaching and Learning. She is a member of the SCImago, CSIC, Spain. She has been a visiting professor at many institutions all over the world. María-Dolores Olvera-Lobo is the corresponding author and can be contacted at: molvera@ugr.es

Juncal Gutierrez-Artacho graduated in 2008 from the University of Granada (UGR) with a degree in Translation and Interpreting. Currently, she is undertaking her Doctoral Studies and teaching Translation at the University of Granada (Spain). Her dissertation is about the importance of translation in the Question-answering systems. Her scholarly articles have concentrated on Retrieval Information and Translation Teaching and Learning. She is a member of some research groups.

This article has been cited by:

1. María-Dolores OLVERA-LOBO, Juncal GUTIÉRREZ-ARTACHO, Macarena Amo VALDIVIESO. 2017. Wikipédia como fonte de informação monolíngue e multilíngue sobre o patrimônio histórico da Espanha. *Transinformação* **29**:1, 5-13. [CrossRef]
2. Elisa Alonso, Bryan J. Robinson. 2016. Exploring Translators' Expectations of Wikipedia: A Qualitative Review. *Procedia - Social and Behavioral Sciences* **231**, 114-121. [CrossRef]
3. María-Dolores Olvera-Lobo, Juncal Gutiérrez-Artacho. 2013. Evaluación del rendimiento de los sistemas de búsqueda de respuestas de dominio general. *Revista española de Documentación Científica* **36**:2, e009. [CrossRef]
4. María-Dolores Olvera-Lobo, Juncal Gutiérrez-ArtachoMultilingual Question-Answering System in Biomedical Domain on the Web: An Evaluation 83-88. [CrossRef]
5. María-Dolores Olvera-Lobo, Juncal Gutiérrez-ArtachoSearching Health Information in Question-Answering Systems 474-490. [CrossRef]
6. María-Dolores Olvera-Lobo, Juncal Gutiérrez-ArtachoOverview of Translation Techniques in Cross-Language Question Answering during the Last Decade 4747-4755. [CrossRef]