The Added Value of Free Online MT Services: Confidence Boosters for Linguistically-challenged Internet Users, a Case Study for the Language Pair Italian-English

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Abstract

This paper reports on an experiment investigating how effective free online machine translation (MT) is in helping Internet users to access the contents of websites written only in languages they do not know. This study explores the extent to which using Internet-based MT tools affects the confidence of web-surfers in the reliability of the information they find on websites available only in languages unfamiliar to them. The results of a case study for the language pair Italian-English involving 101 participants show that the chances of identifying correctly basic information (i.e. understanding the nature of websites and finding contact telephone numbers from their web-pages) are consistently enhanced to varying degrees (up to nearly 20%) by translating online content into a familiar language. In addition, confidence ratings given by users to the reliability and accuracy of the information they find are significantly higher (with increases between 5 and 11%) when they translate websites into their preferred language with free online MT services.

1 Introduction

1.1 Background and Rationale

Online machine translation (MT) technology is today a well-established resource that is available to help overcome a variety of barriers in Internet-based communication. Zervaki (2002), for instance, presents a number of examples focusing on the output produced by four leading free online MT services, examining the reasons for some of their linguistic weaknesses. Yang and Lange (2003) provide an in-depth account of the usage of Babelfish, the pioneer free Internet-based MT system, whilst Smith (2003) describes the setup and applications of the online machine translation facility powered by Systran made available by PricewaterhouseCoopers to its international employees through the firm's Intranet, reporting on company-wide user statistics and feedback.

Outside the corporate and commercial arena, Somers et al. (2006) apply a number of techniques borrowed from the fields of computational stylometry, plagiarism detection, text reuse and MT evaluation with a pedagogical perspective: they propose a range of methods and experiments to investigate how to detect the inappropriate use of free web-based MT tools by language students who take unfair advantage of such resources for their translation homework and assignments, focusing on English as the source language in combination with Spanish, Italian and German. Gaspari (2004a) discusses a number of design-related issues with an impact on the effective integration of a free online MT facility into the home pages of monolingual websites in English for the purpose of disseminating their contents in multiple languages, and Gaspari (2005) describes the technical details of the implementation of this MT-based approach to the translation of online text for a complex and highly dynamic website, providing data related to user testing and evaluation based on 72 multilingual evaluators comparing 4 design prototypes.

Interestingly, the use of Internet-based MT has been recently gaining currency in the research community, as it is becoming increasingly common for online MT services to be considered in research projects focusing on different NLP-related tasks and applications. Hutchins (2003), for example, compares the translations provided by current online translation tools with output from older systems, in order to assess the improvement in the quality of MT for different language pairs historically over the last few decades. Way and Gough (2003) take advantage of three online translation services with a double aim: firstly, to translate phrases needed to populate the database of their example-based MT system and, secondly, as benchmarks to evaluate and compare the performance of different versions of their system in terms of coverage and translation quality. Gough et al. (2002) and Gough and Way (2003) present other studies in which online translation services are used in various ways to provide the linguistic resources needed to implement and evaluate different approaches to the creation of example-based MT systems for the language pair French-English.

Particularly popular at the moment is the trend to take advantage of the output into a particular target language provided by multiple online MT services for the same input, and recombine these candidate translations in approaches that can provide the best possible translation quality, offering the optimal target text by merging the various options that are generated. Different algorithms and strategies to implement these multiple-engine systems combining between three and five online MT services are discussed for various language combinations in Bangalore et al. (2001; 2002), Nomoto (2004), Jayaraman and Lavie (2005), van Zaanen and Somers (2005). Finally, Mellebeek et al. (2005a; 2005b) discuss the stages and challenges involved in the development of an algorithm to improve the quality of the output offered by online MT services, based on the observation that longer input strings tend to result in output of poorer quality.

These are all certainly interesting and useful applications, showing that online MT has matured to the extent that it is increasingly regarded by today's researchers as a valuable resource to conduct studies and implement ambitious NLP systems, serving the needs of the research community and pushing forward their MT development agenda.

This pragmatic attitude was advocated by Church and Hovy (1993), who emphasized the need to maximize the impact of realistic applications taking advantage of state-of-the-art available MT technology, rather than focusing development efforts on areas with limited chances of success. Over a relatively short period of time, computational linguists and NLP system designers have begun to show confidence in using online MT services on an "as is" basis for their own projects with a variety of approaches and purposes.

1.2   Aims of the Study

Against this backdrop the question arises whether this level of confidence is matched outside the research community, i.e. among ordinary linguistically-challenged Internet users who take advantage of online MT services for real-life everyday translation tasks while browsing the Internet. There is a significant body of research focusing on the issues of users' perception of websites, confidence and trust in online providers of products, services and information in a wide range of areas, e.g. e-commerce (Lee and Turban, 2001; Corritore et al., 2003), online banking (Kapoulas et al. 2004) and health advice (Silence et al. 2004), to name but a few.

In the fields of computational linguistics and natural language processing, Resnik (1997) describes a prototype system for the multilingual gisting of web-pages written in a language unfamiliar to a set of Internet users (Japanese), laying emphasis on the value and effectiveness of gisting in supporting decision-making tasks. This study proposes an evaluation framework for multilingual gisting and the role it plays in enabling decision-making processes in real-world tasks. Although the prototype system discussed in Resnik (1997) does not involve proper online MT technology, but performs a set of more limited NLP applications (i.e. language identification, followed by word identification, nominalization and word lookup with a bilingual dictionary, eventually leading to word-for-word glossing of the original web-page), it is nonetheless relevant to the experimental case study presented in the next section because of its emphasis on the behaviour and reactions of people accessing unintelligible web-pages. Richardson (2004) focuses on the experience of deploying MT technology to translate the knowledge base of Microsoft's

Product Support Services from English into four languages (French, German, Japanese and Spanish), so that international customers unfamiliar with English could find it easier to access the required online support documentation. According to Richardson (2004: 247) "customer satisfaction with the articles [machine-translated into Spanish], as measured by surveying a small sample of the approximately 60,000 visits to the web site, averaged 86%", suggesting that in the online environment the vast majority of the Spanish-speaking users were prepared to tolerate the less-than-perfect quality of MT output, which was regarded as an acceptable inconvenience, compared to having to read the original documentation in English.

Apart from these interesting studies, no specific research has been conducted as yet on the confidence of ordinary Internet users in free web-based MT services, looking for example at how reliable and helpful these translation tools are considered to be by the people who are likely to use them for practical tasks when they encounter language barriers on the Internet. This paper aims to contribute to fill this gap, by exploring the impact of using free online MT on the confidence of ordinary web surfers when they look for information on websites that are only available in a language with which they are not familiar. The experiment presented in the rest of this paper focuses on the language combination Italian-English, with a view to illustrating issues that also apply to the other language pairs covered by Internet-based MT tools. The main purpose of this study is to shed some light on the extent to which ordinary linguistically-challenged Internet users who are faced with web content in unknown languages are confident in using free web-based MT services as a reliable tool for information assimilation.

2 Design of the Experiment

2.1 Selection of the Monolingual Websites

A number of key preliminary decisions had to be made about what monolingual websites in Italian should be selected for the tasks that the participants in the experiment would be asked to carry out. A list of a dozen candidates was drawn up, which all met the following criteria, as they were deemed crucial to the success of the experiment: the websites were strictly monolingual and did not have a translation in another language (e.g. a section in English), and their contents were all written in standard correct Italian (i.e. without typos, using everyday written language, etc.); the websites should consist of text-intensive web-pages, with a reasonable amount of non-technical content covering various topics, but not relying on extensive graphic design, since this would have hindered the MT processing (for instance Flash sites were excluded upfront from consideration); the websites should have contact details, and particularly telephone numbers, listed in a separate page that was directly accessible through a link located on the home page; the nature of the websites should not be identifiable in any way from their URLs and they should not be popular sites (so the websites of famous companies with strong brands or Internet addresses including recognizable words were not considered); finally, the URL for the home page of the websites should be as clear and short as possible (maximum 20 characters), so as to be easy to type, minimizing the chance of mistakes.

2.2 Pilot Study

Following the preliminary selection of twelve candidate monolingual websites for the experiment according to this set of criteria, a further choice was made to reduce their number to three, based on a pilot study which involved 17 volunteers. This stage was essential to avoid any bias in the design of the questionnaire which was going to be administered to the participants in the experiment (section 2.6 gives more details on the questionnaire). In order to neutralize cultural and linguistic biases, the 17 people who helped in this further selection of the websites during the pilot study had diverse backgrounds: 6 of them were native speakers of Italian with a very advanced knowledge of English; 3 were native speakers of English with an excellent command of Italian; 2 were native speakers of Spanish and Czech with an excellent knowledge of both Italian and English; finally, 4 had English as their mother tongue and 2 were native speakers of Chinese with an excellent knowledge of English, and none of these had ever learned Italian.

These people checked that the dozen candidate sites were not actually recognizable from their URL and they were not popular ones that ordinary Internet users might be expected to be already familiar with. After doing this, each of the 17 volun-

teers proposed a short description consisting of up to 3 keywords in English that would summarize the contents and the nature of each Italian website. Based on their suggestions, a consensus was achieved on a short description in terms of keywords that would represent fairly the actual content of each website and also reflect the views of the majority. These descriptions were later used in the multiple-choice questions of the questionnaire that was administered during the experiment.

2.3 Stimuli: Monolingual Italian Websites

Following this pilot study, three websites were finally selected for the experiment, and the results presented here are based on them. These three monolingual Italian sites were quite diverse both in terms of content and design, and the following table shows their URLs with the keyword-based descriptions that were used in the questionnaire to identify them:

URL	Description
www.marconionline.it	school
www.rmf.it	radio station
www.siriogatto.it	collectors' items

Table 1. URLs and descriptions for the websites.

The following three figures (1, 2 and 3) show the home pages of these monolingual websites in Italian that were selected to carry out the experiment reported in this paper:
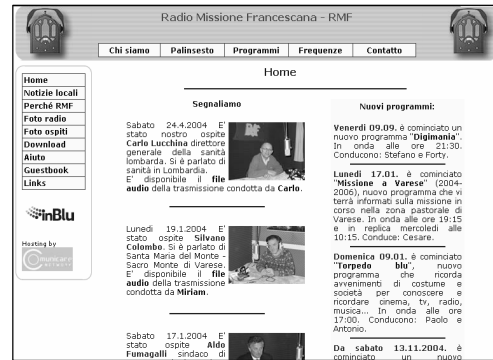

Figure 1. URL: www.marconionline.it.

Figure 2. URL: www.rmf.it.

Figure 3. URL: www.siriogatto.it.

2.4 Participants in the Experiment

A group of 101 English-speaking people with no knowledge of Italian took part in the experiment presented here. They were volunteers involved in a much larger project with approximately 250 participants in total, which took place between April and June 2005. However, for the purposes of this experiment individuals who had some knowledge of Italian were screened out, in order to create a homogenous sample in terms of linguistic knowledge. All of them were either native speakers of English or had a very advanced knowledge of this language, as they were all undergraduate or postgraduate students at British Universities (Manchester, Salford and Liverpool Hope). The 101 participants were divided into two separate sets: 77 individuals formed the main experimental group involved in the study, while the 24 remaining people served as a control group. It was felt that a ratio of approximately 3:1 would provide a reliable basis to conduct the experiment and compare the results yielded by the two sub-groups.

The two sets of participants performed the same tasks, which consisted in looking for basic information posted on the three monolingual Italian websites (i.e. understanding the nature of the website and finding telephone contact details), with one crucial difference: the 77 members of the main experimental group used four of the leading free online machine translation services to translate the web-pages from Italian into English, while the 24 people in the control group looked only at the original websites in Italian. All the participants later completed a questionnaire in English whose aim was to check the correctness of the information they had identified from the three (machine-translated or original) sites, and to get the respondents to rate their confidence in the accuracy of the information they had found.

2.5 Instrument: Online MT Services Used

Four of the leading free online MT services were used in the experiment: Babelfish, Freetranslation, Google Language Tools and Voila.[1] It was felt that covering these popular services would accurately reflect the state-of-the-art in this field, also because these tools are among those considered in the work reviewed in section 1.1, and three of them (i.e. all those mentioned above excluding Voila) are also examined in the study presented in Gaspari (2004b), therefore their popularity is already documented in the literature. The experiment was designed so that each of the 77 individuals in the main experimental sample would use one of these four free online MT services to translate into English the home pages and the rest of the content of the three monolingual websites in Italian on which the key tasks were based. The following table shows how many members of the experimental group used each translation tool during the tasks:

Free online MT service	Number of users
Babelfish	27
Freetranslation	15
Google Language Tools	26
Voila	9
Total number of users	77

Table 2. Number of users for each MT service.

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[1] These are the URLs for these four free online MT systems:
http://www.babelfish.altavista.com,
http://www.freetranslation.com,
http://www.google.com/language_tools and
http://tr.voila.fr .

The difference in the numbers of individuals who used each of the four services is due to the fact that this data was extrapolated from a larger set of participants, therefore the variation was inevitable because the questionnaires were initially filled in by approximately 250 randomly chosen people, and from this overall sample only those without any knowledge of Italian were included in the study presented here. However, a preliminary analysis of the results showed that the responses to the questionnaire were consistent for the four web-based services. As a result, for reasons of space in this paper they are all aggregated and reported together, without considering the slight variations in the results yielded by individuals who used the four different services, which would have required a much more elaborate discussion but without revealing any valuable insights. In addition, the emphasis of this paper is on getting an understanding of the users' perception of the reliability of free web-based MT technology in general, therefore looking at the whole picture is preferable than focusing on the partial details of how users regarded separately the performance of each individual service that was considered in the experiment.

2.6 Evaluation Method: the Questionnaire

The questionnaire that the participants in the experiment were asked to fill in focused on some basic information about the websites, i.e. they were first of all asked what description best defined each of the three websites, choosing one of the following 15 options: tourist information, political party, city council, sports centre, ethnic food, oriental art, astronomy and astrophysics, pets and animals, collectors' items, online newspaper, radio station, photo club, company/corporate, scientist's profile, school. Then the questionnaires asked to identify a contact telephone number from the pages of the websites and write it down, without any other instructions as to how it might be found; in case the respondents were not sure about this piece of information, they could tick a "don't know" option. Finally, after performing these two tasks for each of the three websites, the respondents were asked to rate their confidence in the correctness of the information they had provided for the contact telephone numbers associated with each Italian website, based on a 7-point Likert scale (ranging from "not at all confident" to "very confident").

The format of the questionnaire and the phrasing of the questions were exactly the same for both the main experimental group and the control group involved in the experiment, although the former performed the tasks translating into English the websites in question using free online MT, while the latter looked only at the original web-pages written in Italian, a language unfamiliar to them. This method gave the possibility to check the actual accuracy of the answers provided by the respondents first, and then to establish a relationship with the level of confidence they had expressed in the correctness of the information they found. The intention of this approach was to investigate any difference between the experimental sample and the control group which might be attributed to the role played by the key variable under consideration, i.e. the use of free online MT when performing the tasks.

3   Results and Discussion

3.1   Finding Basic Information Correctly

The first set of results presented here focuses on whether using free online MT services helped the English-speaking participants to be more successful in finding basic information on the three monolingual websites originally available only in Italian. The following table shows the results for the correctness of the answers about defining the nature of the three websites, which the respondents were asked to indicate by choosing one of 15 keyword-based descriptions in English:[2]

School's site `www.marconionline.it`			
Guessed correctly		*Guessed incorrectly*	
MT	*Control*	*MT*	*Control*
N = 73	N = 18	N = 4	N = 6
94.8%	75%	5.2%	25%
+19.8% accuracy when using free online MT			

(continued on next column)

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[2] The table presents the data for the three Italian websites separately. All the results are indicated in absolute numbers (N) and percentage within the relevant sub-group: the "MT" column represents the experimental group, while "Control" refers to the control group involved in the experiment.

Radio station's site `www.rmf.it`			
Guessed correctly		*Guessed incorrectly*	
MT	*Control*	*MT*	*Control*
N = 75	N = 20	N = 2	N = 4
97.4%	83.3%	2.6%	16.7%
+14.1% accuracy when using free online MT			

Collectors' items' site `www.siriogatto.it`			
Guessed correctly		*Guessed incorrectly*	
MT	*Control*	*MT*	*Control*
N = 68	N = 21	N = 9	N = 3
88.3%	87.5%	11.7%	12.5%
+0.8% accuracy when using free online MT			

Table 3. Answers to question on site description.

These results show that the accuracy of the answers is consistently higher in the main experimental group, i.e. for those participants who used one of the four free online MT services to access the contents of the Italian websites. Although the increase in accuracy is negligible for the collectors' items website (+0.8%), in the other two cases the difference is quite substantial (+19.8% and +14.1% for the school's and radio station's websites, respectively). In all three cases the control group correctly identified the right description of the websites with at least 75% accuracy, which suggests that the visual layout of the sites (e.g. the pictures and photos) and some words in Italian similar to English were still helpful to guess the kind of websites, although none of the respondents were familiar with their language. However, there is a clear pattern showing that the respondents who used free web-based MT to translate the online information into English always achieved higher accuracy in their answers.

The data presented in the following table refers to the correctness of the information identified by the respondents when they were asked to find a contact telephone number for each of the three websites:

School's site: contact phone number					
Correct		*Incorrect*		*Don't know*	
MT	*Contr.*	*MT*	*Contr.*	*MT*	*Contr.*
N=62	N=19	N=0	N=1	N=15	N=4
80.5%	79.2%	0%	4.2%	19.5%	16.7%
+ 1.3% accuracy when using free online MT					

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Radio station's site: contact phone number					
Correct		*Incorrect*		*Don't know*	
MT	*Contr.*	*MT*	*Contr.*	*MT*	*Contr.*
N=70	N=20	N=1	N=0	N=6	N=4
90.9%	83.3%	1.3%	0%	7.8%	16.7%
+ 7.6% accuracy when using free online MT					

Collectors' items' site: contact phone number					
Correct		*Incorrect*		*Don't know*	
MT	*Contr.*	*MT*	*Contr.*	*MT*	*Contr.*
N=48	N=14	N=0	N=0	N=29	N=10
62.3%	58.3%	0%	0%	37.7%	41.7%
+ 4% accuracy when using free online MT					

Table 4. Answers to question on contact number.

The results summarized in Table 4 reinforce the previous ones, in that the respondents using free online MT were always more successful than those in the control group in finding the correct contact telephone numbers from the pages of the Italian websites, and in two out of three cases there is also a reduction in the percentage of "don't know" answers for this particular piece of information (radio station -8.9% and collectors' items websites -4%; conversely, there is a +2.8% increase for the school's website). In line with the previous set of results, this data confirms that basic information like a telephone number can be found quite successfully by people scanning through the contents of a website, even though they do not know its language and they do not use any MT facility, and arguably in the case of a set of digits this task is fairly straightforward; in addition, the word for "telephone" in Italian is quite similar to English (i.e. "telefono"). Still, there is again a noticeable improvement in the accuracy and correctness of the information provided by the experimental group who relied on free online MT while performing the tasks, which is of crucial interest here.

3.2 Confidence Ratings in the Answers

The key factor considered in this investigation lied in the perception that the 77 users in the main experimental group had of the reliability of the free online MT services used to translate into English the three Italian websites containing the information that they were asked to find. This part of the data analysis was only applicable to the individuals who had given an answer to the question about the contact telephone numbers for the websites that was different from "don't know". As Table 4 shows, only two individuals gave incorrect answers to these questions related to the contact telephone numbers: one of them in the control group for the school's website (representing 4.2% of the control group), and the other in the main experimental sample for the radio station's website (corresponding to 1.3% of the main sample), therefore these two results offset each other, and they do not play a significant role in the overall data analysis that follows.

It should be noted, however, that for all the three websites a significant quantity of respondents from both the experimental and the control groups selected "don't know" for this answer, particularly for the collectors' items one (37.7% and 41.7%, respectively), which shows that they were not sure about how to find the information that was requested of them. First of all, it should be observed that the percentages of users in the experimental and control groups who expressed this opinion are very similar for two of the websites (i.e. school and collectors' items), while in the case of the radio station the quantities are still comparable, but the percentage is more than double for the control group (16.7% vs. 7.8%). Secondly, in the analysis of the results for the confidence ratings it was felt that it would be more appropriate to exclude the respondents from both the experimental and control groups who had given "don't know" as an answer to the information regarding contact telephone numbers for the websites.

As a result, the following table only includes the cases for each of the three monolingual websites for which either a correct or incorrect answer was provided (as noted above, the latter only occurred in two instances), hence the overall number of individuals included is smaller than the whole sample population. The following table presents the mean values of the confidence ratings given by the respondents on a 7-point Likert scale (ranging from "not at all confident" to "very confident"), providing a comparison of the mean confidence expressed in their answers by members of the experimental group (who used free online MT to find the telephone numbers) and the control group (who only looked at the original Italian websites):

Confidence ratings school's phone no.				
Group	N	Mean confidence rating	Std. deviation	Std. Error Mean
MT	62	5.90	1.490	.189
Control	20	5.10	1.586	.355
+ .80 (i.e. +11%) mean confidence using MT				

Confidence ratings radio station's phone no.				
Group	N	Mean confidence rating	Std. deviation	Std. Error Mean
MT	71	6.54	.876	.104
Control	20	6.20	1.105	.247
+ .34 (i.e. +5%) mean confidence using MT				

Confidence ratings collectors' items phone no.				
Group	N	Mean confidence rating	Std. deviation	Std. Error Mean
MT	48	6.02	1.451	.209
Control	14	5.57	1.697	.453
+ .45 (i.e. +6%) mean confidence using MT				

Table 5. Confidence ratings for numbers found.

The data presented in this table suggests very strongly that using free online MT acted as a confidence booster for the reliability and quality of the information found by the participants when looking for the contact telephone numbers listed in the websites. In all three cases there is a clear pattern of increased confidence (between 5% and 11%) for the experimental group of participants who relied on free online MT to perform the tasks, in line with the previous findings showing that using MT technology also consistently enhances the correctness of the answers.

These results related to the confidence ratings broken down for each of the three monolingual websites can also be presented effectively in visual form, revealing the significant impact that using free online MT had on the confidence ratings during the tasks. The following three figures (4, 5 and 6) plot the confidence ratings for the contact telephone numbers found for the three websites (the

percentages refer separately to the experimental and control groups, and participants who answered "don't know" have been excluded):
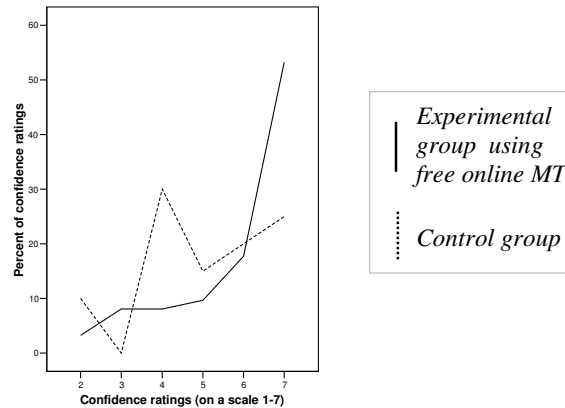

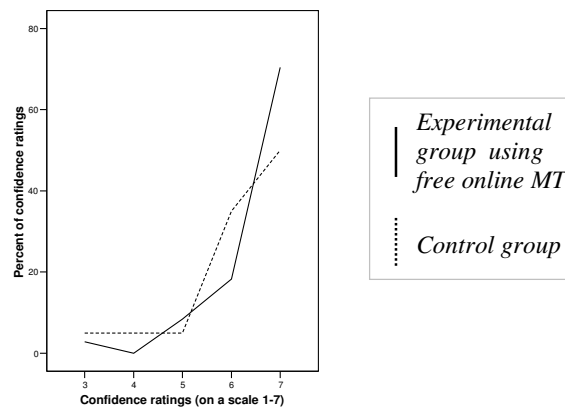Figure 4. School's no.: confidence ratings.
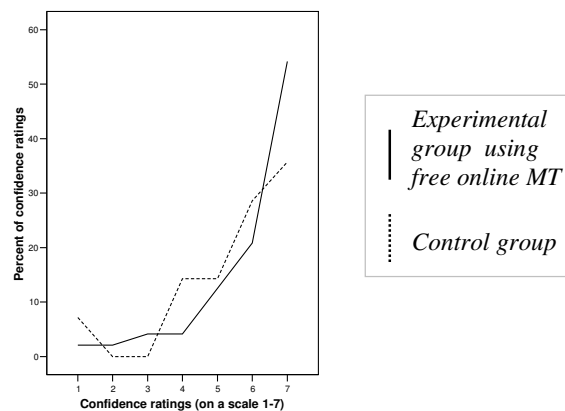

Figure 5. Radio station's no.: confidence ratings.

Figure 6. Collectors items' no.: confidence ratings.

4 Conclusions and Future Work

4.1 Added Value: Confidence-boosting Effect

This last set of findings offers valuable insights into the positive perception that linguistically-challenged Internet users have of using free online MT services, which boosts their confidence in the accuracy and reliability of the information they find while browsing websites available only in a language unfamiliar to them, Italian in the case of the experiment reported in this paper. In addition, the results show that using free web-based MT technology enhances the chances of identifying correctly basic online information available exclusively in unfamiliar languages. It can be argued, however, that the tasks covered in this experiment were narrowly focused on fairly simple questions, since the design and visual elements of a website (e.g. banners, pictures, photos, etc.) go a long way towards revealing to the visitors the nature of its contents, and that the success in identifying strings of numbers as contact telephone numbers can hardly be attributed to the use of free online MT.

Nevertheless, the study has revealed that the experimental group taking advantage of web-based machine translation consistently outperformed the control group, both in terms of giving correct answers and also in rating more highly the confidence in the quality and reliability of their answers. These findings suggest that the community of linguistically-challenged Internet users has a positive perception of free online MT technology, and regards it as a helpful and reliable tool to access the multilingual information available in the online environment. Although one would expect some healthy skepticism when it comes to relying on free MT technology to assist in Internet navigation, the clear confidence-boosting effect seen in the members of the experimental group seems to reveal a pragmatic approach towards the use of this resource. Whether or not this attitude is naïve and possibly underestimates the potential pitfalls associated with using raw unedited MT output for information-gathering purposes is an open question which has been raised by this study.

4.2 Further Research and Future Work

More research is needed to address these issues, supported by robust experiments to collect empirical data to expand on the initial results presented here. Further investigations need to be carried out to consolidate this preliminary body of evidence, covering for example other language combinations and including other online MT services (free or otherwise), or indeed MT systems that can process web content, on a wider spectrum of websites, including for example e-commerce sites. Similarly, this investigation focused on users who had no knowledge at all of the source language involved (Italian), but other experiments could also be carried out in the future considering a user population with some knowledge of the source language as well, to see how this affects their confidence in the MT tools they use.

Finally, this study has concentrated solely on using online MT for information-gathering tasks in a realistic but still relatively artificial setting. It would be very interesting to investigate whether the same positive attitude towards using Internet-based translation technology would also be displayed in different scenarios, for instance when looking for multilingual information needed to make an important informed decision (cf. Resnik 1997), when carrying out online transactions, in more interactive environments like chat-rooms, or even for dissemination purposes, e.g. to provide details requested by electronic forms, post multilingual information on personal web-pages, etc.

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