Machine-assisted translation with a human face

by KENNETH R BEESLEY

Machine-assisted translation and machine translation, with their inevitable acronyms MAT and MT, are terms commonly used to describe a wide variety of computer systems which help translate natural languages, such as English to French.

Abstract: Machine-assisted translation (MAT) has come under much criticism, both from government investors and human translators. However, modern MAT systems are of a high quality, although not perfect.

Most work has been directed at automatic machine translation, which does not require human help. The model used is naive for human and machine translators. Some systems divide the work between the machine and the human. In evaluating any MAT or translator aid, the user needs to consider the overall process from speed to type of text to audience. The most neglected aspect of MAT is the needs, attitudes and sensitivities of the human translators.

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Other terms found in the literature include machine-aided translation, human-assisted machine translation, machine-assisted human translation, computer translation, computer-assisted (or computer-aided) translation and automatic translation. Just as there is little agreement about which terms to use, and exactly what they mean, there are sharp disagreements about the value and future of the whole field. Some researchers, and even more translators, remain convinced that computers cannot possibly be of help in a craft, or art, as subtle as language translation. They cite famous, but probably apocryphal, examples of computer systems translating “The spirit is willing, but the flesh is weak” into Russian and back as “The liquor is strong, but the meat is insipid” and a dozen other suspicious variations. On the other side, proponents maintain that computers are not only valuable in translation, but that they are becoming absolutely necessary to help handle the world information explosion.

In response to the sceptics, there is one unassailable fact: computer systems are being used right now, every day, around the world, for automating translation in government agencies, military installations, translation houses and dozens of commercial companies. In most cases, these users are reasonably happy with the results, and they save money and/or time in the total translation process. ALP Systems is one of several software companies which specialize in creating and selling translation systems.

Machine-assisted translation is today a reality. In the face of this optimism, it should be noted that MT and MAT are not magical or perfect. In the majority of commercial applications, where translations must be of very high quality, human translators must work together with computers to get quality output. There are many ways for people and machines to divide the work, and there are correspondingly many approaches to translation automation, some helpful and some only frustrating.

Short history of MAT

The history of MT and MAT in the Western world goes back at least as far as World War II, when both the UK and the USA built primitive computers to help break codes and ciphers. People began to realise that machines could manipulate letters and words, as well as numbers. As early as 1946, researchers on both sides of the Atlantic were talking about using these new machines and code-breaking techniques to translate documents from one natural language into another.

In the 1950s and 1960s, there were numerous MT research projects at US universities, often funded by government intelligence agencies. Not surprisingly, the emphasis during the Cold War was on translating Russian into English.

Because computers, software and computational linguistics were all in
their theoretical infancy, the early sys-
tems were naturally rather primitive.
Translation was little more than
word-for-word substitution with ad-
tec adjustments for inflection, con-
guration and word order.
From about 1954 to 1964, the US
government was enthusiastic about
MT, pumping $20M into various
projects. However, by 1964 the
government was starting to see suspi-
cious. It wanted practical results and
seemed to be getting none. The As-

   Source
   language
document

Processing

Target
language
document

Figure 1. A simple model of translation

now possible for a company or
government agency to buy a MAT
system 'off the shelf', tailor it for their
internal style and vocabulary, and
then proceed with some part of their
translation process automated. ALPAC
Systems, for example, sells general-
purpose translation systems which
meet the requirements of the inter-
national business community. Other
companies selling MAT systems in-
clude Logos, Systran and Weidner.
The companies compete not so much
against one another as against the
general inertia behind doing transla-
tion the old way. That is, their biggest
competitor is always the absence of
MAT.

Models of commercial MAT

looked at in its most simple and

simplistic form, any kind of transla-
tion, human or automated, starts with
a source-language text, puts it
through some kind of processing, and
ends up with a target-language text
(see Figure 1). In human transla-
tion, this processing would seem to be
largely mental. When considering
how a computer, a mechanical brain,
could help in translation, the first and

   Source
   language
document

Fully
automatic
machine
translation

Target
language
document

Figure 2. Original idealistic approach to
translation automation

became not only scarce but rather
disruptable. Work continued in Can-
da, France, Germany and in a few
commercial companies in the USA.
To this day there is a dearth of
university research in MT and MAT
in the USA. The University of Sear-
brucken in Germany has a research
system, as does the University of
Grenoble in France. There are report-
edly 18 systems under development in
Japan and a few in Eastern Europe.
The German firm Siemens has funded
research at the University of Texas.
The European Community is current-
ly supporting a vast research project in
the hope that MAT will help handle
the translation load that comes with
having seven official languages, which
means 42 language-translation pairs.
Since 1966, when ALPAC con-
cluded that MT was not cost-effect-
ive, a number of advances have
changed the picture. For one thing,
hardware is vastly more powerful and
less expensive that it was in 1964.
Optical character recognition and
word processing cut down on expen-
sive manual typing and retyping.
Designers now know how to make
computer systems that are easy to
learn and to use. Finally, the last 20
years have seen the growth and frui-
tion of theoretical disciplines such as
formal linguistics, computational lin-
guistics and artificial intelligence.
Machine analysis of language has
become increasingly sophisticated.
One sign of the changing climate is
the growth of custom-designed,
special-purpose MAT systems in
organizations such as The Canadian
Weather Bureau, the Pan-American
Health Organization, The Chinese
University of Hong Kong and the
French Textile Institute. It is impor-
tant to note that these are not research
projects but actual production sys-
tems which are used routinely to help
translate specialized internal docu-
ments.
Perhaps the clearest sign that MAT
has arrived is the rise and persistence
of commercial MAT companies. It is
most natural answer has been to make the computer handle all the processing automatically.

Almost all the work in machine translation has been directed at developing automatic machine translation systems that will take an English text, for example, and automatically translate it into, say, French, without any outside human help at all (see Figure 2). This automatic translation model underlies most commercial MAT systems.

Obviously, the ideal for any automatic machine translation system is to produce perfect output, with accurate meaning, correct grammar and appropriate style. In reality, of course, the results are too often disappointing; translation is a difficult and often subtle task. This is not to say that the results of automatic machine translation are useless. Raw output may be sufficient for some purposes, such as information gathering. If more polished output is needed, the raw output can be placed in the hands of a human post-editor who fixes it up, perhaps online using a text editor. So a post-editing phase is usually added to the automatic MT model (see Figure 3).

Another common, but not necessary, feature of automatic translation systems is that they translate whole documents in batch mode. That is, the computer translates the whole document into the target language before the human post-editing starts. The post-editor, therefore, is presented with the whole target text as a fair accomplishment, and he or she must do with it what he can. He cannot influence the quality during the translation phase itself, and he is reduced to a machine output revisor.

Such a model of translation is naive for both human and machine translators. In reality, the traditional human process of converting a document from one language to another is highly complex, often involving several people and numerous dictionary or terminology sources (see Figure 4).

A source-language document to be translated by a translation house might first go through the hands of a translation manager, who will evaluate the document and decide which of his staff or freelance translators is best qualified to translate it. For instance, a translator adept at medical articles might be a failure with legal documents.

While translating, the translator may have access to general dictionaries, technical dictionaries and often a privately maintained file of new terminology (sometimes kept on cards in a shoebox). It may be necessary to undertake terminology research.

In addition, translators can consult their colleagues and even call up the author to ask him what he meant, some translators in Canada have listed the telephone book as their most important reference work.

Translators often dictate their translations, leaving them to be transcribed later by typists. First drafts may be revised by the translator and typed again. After the translator finishes his draft, it often goes through at least one post-edit to ensure accuracy and stylistic coherence. The final draft may be retyped or sent along for typesetting.

The automatic translation model concentrates the computer automation on the linguistic translation itself,
probably the least understood step in the overall translation process. If one
looks at what happens in the traditional human translation process, it
becomes obvious that many steps are candidates for computer automation.
If translators used powerful multilingual text editors instead of dicta-
phones, much time and expensive retyping could be saved. Text editors
can also interface directly with computer typesetters, and electronic
transmission of text controls the office paper shuffle. Writing aids such as
spelling and style checkers can help both the translator and the review
editors. Online term banks can replace the shoebox full of file cards.

While it is now respectable to talk about and produce a variety of trans-
lator aids, for years it has been labelled simplistic or uninteresting,
the emphasis has been on forcing the machine to perform the actual trans-
lation without ever asking for help, something that even a human trans-
lator would find difficult.

Problems are swept under the car-
pet of post-editing, which is under-
played as much as possible. Granted,
all the appeal lies in fully automatic
translation: it is immensely gratifying
to feed an English text into a machine
and watch it print out totally auto-
matically in French, especially if you
cannot read the French which
emerges.

It is crucial to evaluate any MAT
system with the overall translation
process in mind. The actual conver-
sion from English words and gram-
mar to French words and grammar is
only one part of the obstacle course
leading from source text to equivalent
target text. Gains in this one area may
be offset by the cost of putting the
source text in machine-readable form.
The cost of post-editing raw output
may also be prohibitive. Claims about
MAT increasing speed and translator
productivity are easily made and
should be scrutinized objectively.

Human translators and machines
— dividing the work

In most MAT applications, trans-
lators and machines must somehow
work together to get acceptable out-
put. The most interesting classifi-
cation of such systems, from a user's
point of view, hinges on how the
translators and machines divide the
work.

The simplest division of labour is
illustrated by the Taum-Meteo system
in Canada, which translates weather
reports from English into French (see
Figure 5). As the weather reports
come in electronically from around
the country, they are sorted by the
machine (essentially an automatic
translation manager) into easy and
hard text.

The easy text, about 80% of the
total, is translated automatically by
the machine, and the output is used
without post-editing. The remaining
20%, harder and more interesting, is
sent directly to human translators.

The success of this system is partly
due to the limited subject matter (the
weather), the resulting limited vocab-
ulary and the restricted telegraphic
style of the reports. Using Taum-
Meteo, the Canadian government is
happier, and so are the translators,
who used to last about six months
before the tedium of translating
weather reports drove them to other
jobs.

Sometimes the raw output of an
automatic system can be improved by
pre-editing the text to be translated,
solving potential problems at an early
stage. There are some constructions
in English which are harder than
others for machines to handle. These
include conjunctions, prepositional
phrases and noun-noun compounds as
in small car factory and aluminium
cylinder head gasket. The Cult system
at the Chinese University of Hong
Kong, which is used to translate
Chinese mathematical papers into
English, requires extensive pre-

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**Figure 5. Human translators and computers — ways to divide the work**

**Figure 6. The system divides the text segments which are displayed one-at-a-time in a window**

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Five people came to the party.

SELECT TRANSLATION FOR: party
а. festa
b. ricevimento

Figure 7. The user is presented with choices for translating words

The Tiritus system used by the Textile Institute of France is used only for translating textile abstracts for purposes of information gathering. Every abstract that comes in has to be extensively rewritten into a standard form to ease the translation process (see Figure 5).

If an organization translates only its own internally produced documents, then it can require its writers to use a specially-defined, customized language which avoids problem constructions. The effect is similar to but less drastic than rewriting or pre-editing. The hope in pre-editing and controlled writing is that the raw output will be better, requiring less human post-editing.

By far the most common approach to MAT today is to let the machine translate normal technical text fully automatically, producing a raw translation which is then turned over to human post-editors (see Figure 3). If the output is good, and it can be in limited applications, then this post-editing step is relatively painless. If the output is poor, post-editing can be a frustrating and demoralizing chore.

The new goal in most modern MAT systems is not to do away with post-editing entirely — even human translations are post-edited to some extent — but to keep it down to an acceptable, cost-effective amount. Commercial systems designed for automatic batch translation and human post-editing include Systran, Weidner and Logos.

Both the post-editing and pre-editing strategies just mentioned assume an automatic machine translation stage where the computer system produces a raw translation without human assistance. The most important point to understand here is that the ALP Systems approach to MAT is different. The ALP Systems Transactive product relies on interactive translation, involving close teamwork between the system and the translator during the translation process itself. In addition, it does not translate whole documents in batch mode — rather it presents its results sentence-by-sentence for immediate human review.

Using this system is an interesting exercise in human/machine interaction. The process starts with the translator designating the text to be translated. Next the translator consults a library of dictionaries and designates those general and technical dictionaries appropriate for the text to be translated. In a process called Distruction, a new document dictionary containing only those words needed for the text is extracted from the chosen dictionaries.

The ALP Systems program then divides up the text into segments, usually one sentence long, which are displayed one-at-a-time in a screen window (see Figure 6). All the words are looked up automatically in the document dictionary.

Many potential syntactic and lexical ambiguities are resolved by the system itself, but when it comes to clear an ambiguity in the source text, the program simply asks for help to the user, presenting him with questions designed as simple menus. The ambiguities commonly found in a source text are usually of three kinds: vocabulary, grammar and syntax. Here the user is being asked to select an Italian translation for party — there are two equivalents in the dictionary: festa and ricevimento (see Figure 7). By typing 'a', the user selects festa and processing continues.

After the segment has been clarified according to the user’s answers, the system then displays its own first-draft translation of the segment in a second window (see Figure 8). Note that the selection of festa, which has feminine gender, has had a ripple effect, causing the choice of the feminine article la — with contractions, 'to the party' comes out as alla festa. If ricevimento, a masculine word, had been chosen, 'to the party' would have come out as al ricevimento. If a fully automatic system chooses the wrong translation equivalent, it can spread throughout a document. Fixing it during post-editing is not as simple as searching for and replacing the offending word with the correct one, the ripple effect can also require changes to related articles, contracted articles, adjectives, participles, verbs and other words.

In the ALP Systems program, any necessary fine-tuning of the output is done immediately, sentence-by-sentence. The user can easily delete, move, add or amend words using a

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built-in multilingual text editor. The bottom window serves as a work area if needed. Otherwise, the user can simply hit a function key and move on to the next segment. Both the source and target texts remain displayed in their respective windows, allowing direct comparison at all times. This is one of the greatest advantages of the sentence-by-sentence mode.

Another important benefit of the sentence-by-sentence mode over the batch mode is the ability to make changes to the document dictionary at any time during the translation process. Whole entries and equivalents can be added, existing inappropriate equivalents can be suppressed and coding errors can be rectified before the problems spread throughout the text. For example, if the translator determines that *festa*, rather than *ricevimento*, will be the appropriate translation for 'party' in the rest of a document, he or she can enter the dictionary and suppress *ricevimento*. In the example just shown, *festa* would then be chosen automatically, without any interaction. As dictionaries are fine-tuned, translators can see immediate improvements in the speed and quality of the output.

This system provides maximum assistance to the translator, semi-automatically providing a first-draft translation of each segment. It is different from most other commercial MAT systems in that it does not produce a raw machine translation fully automatically. Rather, because it is interactive, its output has already been reviewed by a human translator and can be treated as a first-draft human translation.

Transactive systems are currently available for the language pairs: English-French, English-German, English-Spanish, English-Italian and French-English.

Another example of a translation aid is Autoterm. With this program, the user specifies the technical dictionaries to be consulted.

Autoterm divides the source text automatically into segments, which are displayed one-at-a-time in a screen window (see Figure 9). The words are then automatically converted to their base forms, if necessary, and are looked up.

Words and whole phrases found in the dictionary are displayed in a second window with their target equivalents.

The translator then creates the translation in a third window, putting in any of the target terms he or she needs with a keystroke. In this simple example, the translator has typed *Cinque* and can pull down *persons* by simply typing the tag number '2'. In a real example, dense with technical vocabulary and long multiword phrases, Autoterm can speed up translation considerably.

Autoterm provides a different type of assistance from Transactive in that it simply automates terminology look-up and accelerates typing. The translation itself remains completely under the control of the translator. Translators often appreciate this personal control, and the feelings and insights of translators have all too often been ignored within the whole field of MAT. In addition, everyone in MAT freely admits that many kinds of text are awkward and impractical to translate using automatic or semi-automatic systems — it may be necessary for example, to perform wholesale syntactic revisions of machine-translated documents to achieve natural-sounding translations. Autoterm thus fills a significant but seldom addressed need for automation in the overall translation process.

Autoterm is currently available for the source languages English, French, German, Spanish and Italian. Target dictionaries can be easily constructed for any language using the Roman alphabet.

The company recognizes that a powerful, friendly, multilingual text editor is the most basic translator aid of all, and it should form the core of any higher-level translation aid. Multilingual text editor does not mean just any word processor, but one which is designed from the beginning to handle multiple languages naturally, providing familiar keyboard layouts and all necessary punctuation, accents and letters.

Important features include the ability to reset the keyboard (with a simple keystroke), say from the English QWERTY layout to French AZERTY or German QWERTZ, and the ability to type multiple languages in the same file. The translation aids are built around such a multilingual text editor, which can be used not only to edit texts but to compose them.

Although more and more documents are being created on word processors and text editors, and so are already in machine-readable form when handed over for translation, most documents to be translated still arrive typed or printed. Before they can be translated using any automatic or semi-automatic MAT system, they must be converted to a machine-readable form, usually by manual retyping. The cost of this step, which is often underplayed in discussion of MAT, can cancel out the benefits, especially for shorter texts. Using a system such as the ALP Systems multilingual text editor, a translator can consult a hard-copy, source-language document and type the translation directly.
Conclusions

- The translation and document production processes are highly complex. Many translation-related activities are candidates for automation.
- Machine-assisted translation is the approach in which the human translator works with the computer (interactive approach).
- The international business community has accepted machine-assisted translation tools as a realistic solution to their multilingual document production problems.

In addition to providing all the characters and punctuation marks required for virtually any European language, the ALP Systems multilingual text editor allows the user to type a word on the screen for automatic look-up in an ALP Systems online dictionary. As in Autoterm, the translation equivalents of the word, if found, are displayed on the screen and can be pulled into the text with a simple keystroke.

Considerations in evaluating automated translation systems

No single system can meet the varied needs of translation automation. Translation is a highly complex process, and many steps are candidates for automation. In evaluating any MAT system or translator aid, one needs to look at the overall process, considering overall speed and productivity, bottom-line cost-effectiveness, output quality, the type of text to be translated and the audience for the translations.

Even with improvements in translator productivity, it is possible for MAT to cost as much as or more than normal human translation, because MAT carries its own costs. But even in such cases, increased speed of machine translation can still tip the balance in favour of automation. For example, national laws and practical necessity are forcing more and more multinational companies to translate their documentation before marketing their products in foreign countries. The introduction of a new product can be seriously delayed while waiting for the documentation to be translated, and even a slight delay in a competitive market can be financially disastrous.

The most neglected aspect of MAT is perhaps the most important: the needs, attitudes and sensitivities of human translators. MAT researchers often ignore the fact that human beings have to use their systems. No matter how much automation is introduced into a translation shop, human beings are still going to have to run the machines, and human beings are still going to be responsible for the quality of the translations produced. The cooperation of human translators is therefore essential to making any MAT installation work. If translators are saddled with intimidating and inappropriate technology, or if the machines become their masters rather than their slaves, then the technology will fail — the translators will see to it.

Given that human translators have to work together with MAT systems for most purposes, the design of the man/machine interaction becomes very important. For example, machine translation designers have had the arrogance to tell translators what they need and how they ought to do their work. They have ignored the cries of frustration from translators forced against their will and better judgement to become servants to a machine, burdened with unreasonable amounts of pre-editing, post-editing or interaction.

They have offended translators, who often have an arts background and who distrust computers, by suggesting that the machine can replace them. They have ignored the fact that translators differ in temperament and method, and so will prefer differing amounts of assistance, if any, from a computer.

At various times and with various tasks, some translators will find that typing their own translations with a multilingual text editor is the most automation that they can handle and benefit from. Some will consult a term-bank or machine dictionary more than others. Many will appreciate having technical words looked up automatically and displayed on the screen. Some will appreciate having the computer provide a first draft translation for them to work with.

Conclusion

In conclusion, automated translation is already being used in government agencies, the military, translation houses, and general industry. Dependence on MAT will no doubt explode in the next few years, and several software companies, including ALP Systems, are already moving ahead to claim a portion of the market.

Except in those cases where raw output is acceptable for simple information gathering, MAT always involves people and machines working together. The attitude of the people often determines the success of any installation, and the quality of the human/machine interface is crucial. The most interesting classification of MAT systems, from a user’s point of view, is based on how human translators and computers divide the work.

Finally, the cost-effectiveness of a MAT system must be judged in light of the overall translation process, which is highly complex. Many steps in the translation process are candidates for automation, and different kinds of automation (including different levels of assistance) are appropriate for different translation tasks. ALP Systems offers a wide range of translator aids to meet the wide range of translator needs.

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