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## *The Issues of Machine Translation*

MURIEL VASCONCELLOS

*Machine translation!* The very words evoke a range of emotions from disdain, fear, and disbelief to bedazzlement and thrilled expectation. They also raise deep doubts, aesthetic and even moral. And they bring up myriad practical questions about what “MT” really is.

Broadly speaking, MT is *the technology whereby computers attempt to model the human process of translating between natural languages*. Although human beings almost always intervene at different points in the job stream, especially at the end, the underlying process is automatic: the machine is in charge of the transition from one language to the other.

Whether or not MT really does produce translation, and what its impact may or may not be for “human” translators will be discussed in the pages that follow. The profession can expect to be faced with an increasingly broad spectrum of issues begotten by this technology. These issues will get larger and take on new colors and flavors as the use of MT takes a quantum leap forward with the advent of affordable software on desktop PCs, available for all and sundry to experiment with.

Many humanists, including translators, find abhorrent the very idea of turning over to a computer a process as profoundly creative as translation. Indeed, a sensitive translation takes into account every thread of implication in a text, weighs its relative importance within the entire fabric of communicative systems in the source language, and reproduces the same nuances in the target language—necessarily a different set of systems—with all proportions kept. So daunting is the challenge that an eminent philosopher once referred to translation as “probably the most complex type of event yet produced in the evolution of the cosmos” (Richards 1953).

At bottom, the objection to MT is that the computer is presumed to *generate* the translation. And in fact the defining characteristic of MT has always been that the computer generates the output—i.e., so-called “translations” of natural language text fed to it at the input end—even though the process almost always involves some form of human assistance as well. On the other hand, there has been little or no objection to MT’s counterpoint, *machine-aided translation*, in which the human being generates the translation and enlists the computer to speed up the task. In the first case the computer has an active role, whereas in the latter it is passive, standing by like a well-trained butler waiting to do its master’s bidding. These, at least, are the two ends of the spectrum; recent technology is beginning to make the distinction less clear-cut. Today once-passive data bases are serving up increasingly larger chunks of text—for example, matches of translations in progress drawn from text stored in memory—while on the other hand sophisticated MT systems are planning to tap into terminological knowledge bases so that they can make smarter choices as they crunch their sentences (Schütz and Ripplinger 1993; Mitamura, Nyberg, and Carbonell 1993).

For many admirers of the translation process, a translation generated by computer is, a priori, a bumptious affront to human creativity. Others who do not feel quite so strongly accept that MT might be used in some circumstances but worry about its dehumanizing effect on translators, believing that it will turn them into slaves to the machine. Or worse still, they fear that the machine may end up taking the translators’ place.

These and other issues have been being aired ever since MT first reared its head nearly half a century ago. Although patents for translating machines were granted as far back as 1933, the idea of using computers to perform translation is considered to date from a proposal advanced by Warren Weaver, an official of the Rockefeller Foundation, some 15 years later (Weaver 1949). The technology got its first major boost in 1954 in the wake of wide press coverage of the Georgetown-IBM experiment. This two-year project, sponsored by IBM and carried out by Georgetown University in Washington, D.C., culminated in a demonstration on January 7, 1954, in which a set of 49 simple declarative sentences were translated from Russian to English. The experiment showed that the computer could look up vocabulary, recognize the case endings in Russian and provide a preposition or other appropriate equivalent in English, perform minor rearrangement, and make choices between certain words on the basis of syntactic cues (Zarechnak 1979:21–33).

This event was crucial. Far more than the early MT patents and the Warren Weaver proposal, it was the 1954 demonstration and its attendant publicity that gave MT its start in life. What had been a light in the scientists' eyes was now a reality. The event was also a turning-point in that it mobilized the first recruits in what was to be a growing and vocal army of critics who felt that MT was an offense to the genius of language and to the translation profession in particular. And at the same time, it inspired enough optimism and high expectations to launch a sizable government spending spree.

The years since then have witnessed a growing demand for translation in a shrinking world. The translation needs of the U.S. intelligence community, for example, have increased 20-fold since 1960.<sup>1</sup> Over this same period, the international marketing of high-tech products has generated an immense demand for customer support manuals written in fairly simple and repetitive language, required on an urgent basis so that these products can be introduced in multiple markets simultaneously. Today's needs for translation can no longer be met in the context of current budgets and translation costs. As a result, managers look to MT, now quite widely available, as a likely source of help in overcoming the language barrier.

MT has had a checkered career—buffeted, on the one hand, by the telling arguments that have been waged against it and, on the other, by expectations borne of acute need. Despite the ups and downs in its acceptance, however, the product itself has slowly but steadily improved in an ever-growing number of domains and languages. Great strides have been made in syntactic and semantic analysis; some of the pragmatic aspects of language are being addressed; and large quantities of acceptable, or at least fixable, output are being produced and actually used. It is now safe to draw two significant conclusions. The first is that MT is here to stay. The second is that the professional and humanistic issues which it raises are not going to go away.

### *ATA Addresses the Issues*

In 1993 the American Translators Association, concerned about the technology's growing impact on the translation profession, reached out to its 4,500 members in an effort to better understand translators' true concerns, needs, and desires with respect to MT. The purpose of the initiative was to learn which issues were of greatest importance to ATA members

and to find out what role translators wanted the Association to play in meeting the challenge. The resulting information will presumably be the basis for a responsive long-term ATA policy in this area.

A questionnaire, developed by the Association's Committee on Machine Translation, was published in the June 1993 issue of the *ATA Chronicle*.<sup>2</sup> The centerpiece of this poll, and the real focus of the exercise, was a set of 36 statements about machine translation, designed to measure ATA members' attitudes. Each was a commonly heard perception about MT. One-third of the statements were deemed by the developers of the survey to be "negative," one-third were considered "neutral," and one-third were felt to be "positive." The order was scrambled. For each statement, the respondent was asked to check one of six boxes: (1) strongly agree, (2) somewhat agree, (3) neither agree nor disagree, (5) strongly disagree, (4) somewhat disagree, or (6) need more information. Other questions were designed to find out about the respondents' use of computers and their experience with MT as such, as well as to elicit their opinions about various activities and programs which might help to meet their need for more information on the subject.

Unfortunately, the responses had not been compiled and analyzed at the time this book went to press. However, many of the statements in the poll bring to mind the professional issues that translators face. The following sections will refer to some of these issues and discuss the pros and cons as well as the myths and realities. Since the ATA responses were not yet available, in some cases reference has been made to experiences reported in a survey conducted in June 1993 by the International Association for Machine Translation (Vasconcellos 1993a).

### *Prevailing Impressions*

For those who framed the questionnaire, it was easy to draw up a list of prevailing negative attitudes and perceptions about machine translation. Particularly among translators, such impressions abound. It is understandable that translators should have given thought to the issues that MT raises and, even more so, to the translation process itself. After all, translators are the people who really know what translation is about. And for practitioners of the art of translation, it's far easier to imagine why a machine can't do what they do—if not one of the most complex events in the evolution of the cosmos, certainly a formidable task—than to think of ways

in which it might share the burden. Regardless of whether they see MT as a threat or a boon, translators are quick to come up with a rich array of reasons why it could have a negative impact on the profession. Although their views tend to be routinely dismissed by others—managers, system developers, translation consumers, the general public—as a latter-day Luddite response, the picture is not that simple. There *are* negatives, even when they are offset by positives. Those who actually use MT may report varying degrees of success—from “the jury is still out” to “indispensable for high-volume jobs” (Vasconcellos 1993a), but common to all of them is a sense that the disadvantages simply have to be accepted because they are outweighed by a series of important benefits to be gained. Always there are tradeoffs, new skills to be learned, and adjustments in the distribution of tasks.

Starting from the recognition, therefore, that “MT is gray”—pluses come with the minuses and vice versa—the following pages will examine some of the impressions most often cited, whether by translators or others. Not surprisingly, at the very head of the list is the Rice Bowl Thing:

- MT WILL TAKE JOBS AWAY FROM TRANSLATORS.

Alas, there is some truth to this statement. To examine the issue fairly, it is important to make a distinction between *existing jobs* and *new work*. As far as existing positions in translation services are concerned, MT does not loom as an imminent threat. The greater danger is that translator posts will fall victim to the worldwide across-the-board trend to replace in-house workers with contractors—in this case, free-lance translators or translation agencies. In most in-house translation services, work volume is growing by leaps and bounds and current resources are thinly stretched. In some cases MT may be introduced, but the increased productivity is more likely to reduce backlogs than to trigger any near-term layoff of staff.

The record shows that there have been a few cases in which MT actually led to a downsizing of in-house translation services. One of these is Environment Canada, which reports<sup>3</sup> that MÉTÉO, the system which translates weather forecasts from English to French and French to English, churns out some 17 million words a year, the equivalent of possibly 30 person-years of traditional translation work, for an all-time total that long since passed the 150-million mark. Up until 1978 translators did this job by hand, of course, and they had to work in shifts around the clock. They quickly got tired of the hours and the monotony, and there was high

turnover. Today there are eight translators on staff. MÉTÉO does 85% of the workload; the humans do the other 15% and lightly scan the MT output, changing less than one sentence in 20. While it is true that only a small core of professionals remain on board, and that most of their work is postediting, apparently job satisfaction is greater. Such tasks as building the dictionaries and suggesting changes to the development team relieve the tedium.

It has also been said that the installation of Russian-English SYSTRAN in 1969 at the U.S. Air Force's Foreign Technology Division (now Foreign Aerospace Science and Technology Center—FASTC) resulted in less work for translators of Russian. While there was in fact a decline in the amount of work farmed out, in-house staff strength has remained about the same. According to a manager at FASTC, the drop in contract work is due not so much to MT as it is to a policy decision to discontinue cover-to-cover translation of Russian scientific journals.<sup>4</sup>

The few past cases of downsizing should be viewed in the context of a much larger situation: trends in world politics and the global economy have made for major shifts in the translation market itself. The broader issue that translators need to be addressing is how to reposition themselves in a market dominated by immense volumes of work associated with localization—everything involved in introducing a product or technology in an overseas market, including packaging, procedural guidelines, maintenance instructions, customer support manuals, computer screen displays, and even actual program code. The size of some of these projects boggles the mind: one company turns out 45 million words a year, over half of which is done using MT; another is translating 125 million words over a several-year period, all of it by MT. Work of this kind may well represent the largest demand for translation in the world.<sup>5</sup>

- TRANSLATORS NEED TO BE PREPARED TO DEAL WITH MT.

What happens when MT is introduced in existing in-house translation services is that people are needed for new tasks, principally to collect terminology and feed it into the MT system, as well as sometimes to prepare, or “pre-edit,” the input for the machine. Meanwhile, most of the translators continue to translate, some of them postediting MT on-screen. If the decision to adopt MT was the right one and the operation turns out to be successful, some or all of the translators who are postediting will be producing more work, camera-ready, than they did before. These tangible

gains in productivity will, in turn, lead managers to consider long-term restructuring.

Of course, everyone involved is learning new skills. This means that sooner or later jobs will get redescribed. Eventually, both for old positions redescribed and for new posts created to fit the changing scene, recruitment will be narrowed to those who have adapted to the new technology. Although there is no substitute for hands-on experience, it is hoped that before too long there will be well-designed courses and thoughtfully prepared training manuals that will help translators to make the transition. While general information can be provided in professional translator publications and in seminars and conferences, the training that is needed is much more detailed.

- POSTEDITING IS DIFFICULT AND TIME-CONSUMING; ANY TRANSLATOR COULD DO THE JOB FASTER FROM SCRATCH. IT IS ALSO BORING AND DEMEANING; THE TRANSLATOR BECOMES A SLAVE TO THE MACHINE.<sup>6</sup>

For sensitive translations and texts that are to be published, it is essential that the machine's output be reviewed by an experienced translator or a technical expert who is proficient in editing and has a good knowledge of the source language. In the case of (1) a highly developed system being used (2) in a restricted domain (3) with a small vocabulary and (4) a limited set of linguistic structures, it may be only a cursory pass and the intervention may be minimal—as with *MÉTÉO*, for example. But this step cannot be avoided if the client cares about having a correct translation. The posteditor's role becomes even more crucial—and far more challenging—with general translations covering a range of discourse types and subject areas.

There is no question that learning to work with MT output entails a radical adjustment. Postediting is not the same as translating, and not all translators enjoy it. On the other hand, some do. Some become very proficient, increase their productivity, and find that it is less tiring than traditional translation. Often they don't realize how addicted they have become until the machine breaks down or for other reasons they are faced with a translation to do by hand—especially if it is repetitive or has a lot of numbers to copy, pesky format codes to insert, or technical terms to look up. On the other hand, many translators do not take to the process at all. An unfortunate experience at the outset could turn them against MT for good.

There are many reasons why postediting could seem like an overwhelming task. To begin with, the environment could be at fault: the MT system being used could be immature or unsuited to the particular text type; the input text could be poorly written, highly complex in structure, or otherwise inappropriate for MT; or the word processor itself could be cumbersome, without macros to speed up routine maneuvers. There's a degree beyond which trying to fix up the output is no longer worthwhile.

At the same time, the environment isn't everything: the posteditor (who *must* work directly on-screen), should have crackerjack word-processing skills, awareness of postediting strategies, and, above all, a genuine flair for fixing up text. A posteditor of general translations really needs to be a translator-cum-editor. He or she must have the knack of "zapping" a text in just the right places with a minimum of intervention. Some postediting strategies can be learned (Löffler-Laurian 1986, McElhaney and Vasconcellos 1988, Santangelo 1988, Vasconcellos 1985, 1987a, 1989a), but more important is an underlying mind-set which not all translators have. A confidential study conducted in 1986 showed that translators who volunteered to learn MT postediting—all of them experienced and competent professionals—exhibited three basic learning curves: (1) a steep rise at the outset which quickly reached a plateau, (2) a slow and gradual rise that ultimately reached the same level of productivity as the first group, and (3) an essentially flat curve that barely got off the ground. In addition, like regular translators, posteditors must have sufficient knowledge of the subject area and type of discourse to be able to understand the processes being cited and use the right terminology. The level of knowledge required is similar to that of a reviewer or reviser of translations, though the task itself is somewhat different (Vasconcellos 1987b).

This background needs to be understood in order to reach meaningful conclusions about the charges most often leveled against postediting—namely that it's *difficult, time-consuming, boring, and/or demeaning*.

The *difficulty* of postediting varies depending on a large number of factors, including the capacity of the MT system, the word processor/macros being used, the nature of the input text, and the word-processing skills, experience, exposure to the domain, MT "training," and mind-set of the person doing the job. To reduce the variables involved, let's assume that the input text is above reproach, the MT system is well developed for the purpose in question, word-processing macros are available, and the translator fills the bill. With simplified or repetitive language or in highly restricted domains, postediting can be easy and quick. With general

translations, on the other hand, it can indeed be very difficult—as difficult as traditional translation, with new skills to be learned in addition. For the beginning posteditor, it may take from one to three months of full-time practice before the learning curve reaches a comfortable level. Even at that point, the fact that more work can be produced in less time is deceptive: the brain-twisters are coming up at a faster rate; it needs to be recognized that when the demand for quality is high, the mental effort required for MT postediting is in ways even greater than that needed for traditional translation.

Postediting should not be *time-consuming* if the circumstances are “right”—in other words, if the input text is in the form of an electronic file and if the MT system, the choice of texts, the word processor, the macros, and the posteditor’s background and inclinations are in tune with the task. MT users who keep statistics quote productivity increases ranging from 25% to nearly double. In the IAMT study, managers or translators from a total of 18 user sites volunteered positive testimonials about turnaround or productivity. With regard to speed, some of their comments were:<sup>7</sup> “At least 1.8 times better than human-only translation.” “Turnaround time is greatly improved.” “Turnaround time 6 minutes” [for a weather bulletin]. “Faster turnaround.” “Ability to get products to market faster.” They also said: “Increases productivity.” “40% cost reduction.” “Cost savings of nearly 50%.” On the other hand, a new user said: “No improvement in speed so far.” Elsewhere a freelance translator who has started to use a PC-based system volunteered that she is seeing “a gain of 25%–50% at no extra cost” based on an average daily rate of 5,000 to 6,000 words.<sup>8</sup> If the factors affecting turnaround cannot be adjusted to show a gain over human translation, then it may well be that MT should not be used for the application in question. There is no point in trying to ride a horse that can’t get off the ground!

Whether or not postediting is *boring* or *demeaning* will depend on the environment and the perceptions of the individual. Translators may feel less bored or demeaned if they feel positive about the advantages that MT offers. It is interesting to look at the following comments from veteran posteditors, also from the IAMT study: “[It] lightens [my] load.” “No cumbersome typing.” “Beneficial for us because the kind of text we translate is very dry and repetitive.” “I really enjoy working with [this MT system] . . . the machine generates a draft translation performing the most boring part of the task so that I can concentrate on perfecting the output.” On the other hand, another MT user made the following ambivalent and

thought-provoking comment: “One of the advantages mentioned by salesmen, etc., [namely] that MT relieves translators of boring repetitive tasks, is not relevant in my opinion as there are other repetitive tasks instead: text conversion, parameter editing, deformatting, [etc.] I enjoy working with MT because it is an interesting tool and you learn a lot, but whether it really beats manual translation remains to be seen” (Vasconcellos 1993a).

Postediting should never be imposed to a degree or in a way that results in abusive working conditions for translators. Their “bill of rights” should allow them to always have the option to switch to human translation, with corresponding compensation, whenever they find that a given assignment is unsuitable for MT—and they should be the ones to make this decision. Clearly, if MT increases their productivity by any sizable margin, they should be only too glad to use it.

- MT CONSTRAINS THE CREATIVE USE OF LANGUAGE.

Under appropriate conditions, a clever translator who meets the qualifications described above can use MT output creatively to produce excellent translations (Vasconcellos 1985). The quality of a good postedit is not *necessarily* inferior to that of a good human translation.

Sometimes it is possible to compare the two modes when the same translator uses them both within a single translation job (usually because part of the input text was on a disk and the rest was hard copy). For purposes of argument, it will be assumed that quality is a requirement and that the MT is supposed to mesh seamlessly with the human translation. What appears to happen is that MT produces a quick initial draft, but the draft may need to be rather heavily reviewed in order to give the text a natural flow. The human translation usually takes longer to produce, but it tends to sound more natural.

Often the human translation has a certain *je ne sais quoi*. Élan? Dash? Sparkle? Verve? Vigor? Vitality? Whatever it is, MT doesn’t seem to have as much of it. Four of the IAMT respondents (Vasconcellos 1993a) commented on this problem: “It somewhat inhibits creativity.” “Loss of idiomacy and style.” “Resulting text is a little stilted and awkward.” “Excessive adherence to MT output changes expression.” This is a factor that should be kept in mind when texts are being selected for machine translation. Perhaps the ideal situation is to provide the translator with MT output and allow him or her to move back and forth, depending on

how the translation is coming along, with no reduction in compensation for using MT in the case of freelancers.

On the other hand, MT sometimes gets a bum rap. People with strong prejudices may complain about postedited MT without justification. In feedback collected during an 11-month study at the Pan American Health Organization, the end-consumers, who did not know whether or not MT had been used, reported equal satisfaction with both modes; in fact, there were more complaints about traditional human translation (Vasconcellos 1989b).

While there is no inherent reason why a postedited product should sparkle less than a human translation, special precautions may need to be taken. There are times when the posteditor will have to go over the postedit slowly and carefully, or in a separate pass, to smooth out any awkward constructions.

- MT WILL RESULT IN LOWER STANDARDS OF TRANSLATION QUALITY.

The clever translator in the paragraph above also has to be wide awake and working in an environment conducive to maximum concentration. When posteditors get tired or are forced to work amid interruptions, or when there is too much pressure for fast turnaround, quality often suffers. In these circumstances, sometimes the fact that the text is already on the screen can relax the translator's guard too much. It invites complacency. For some strange reason, the screen seems to be more forgiving than hard copy.

In the exercise above, in which the translator is faced with a mixed HT/MT assignment, the first-pass postedit is definitely inferior to the draft human translation. For a quality translation, the postedit needs to be reviewed at least twice again in order to catch the many little lapses that tend to creep in. The human translation is closer to a final, polished product. It can be reviewed more quickly. Machine translation will still be faster, but not by as great a margin as might be expected from the speed of the first pass.

Some of the problems that can occur when the posteditor is under pressure include: portions of the text left unseen, word-processing errors, awkward passages, misconstructions of the original meaning (usually due to insufficient checking against the original text), failure to detect blatant mistranslations, an incorrect name of an important entity or institution, a

garbled proper name, etc. In some cases an oversight can be quite serious. The translation consumer relies on the accuracy of postedited MT (whereas raw MT, clearly labeled, makes no promises).

When translation quality is a priority, it is important for the translator to be aware of the risk of lapses and try to prevent them by staying refreshed, minimizing interruptions, and planning ahead, insofar as possible, to avoid last-minute rushes. It is also essential that the postedit be double-checked, including at least one review on hard copy.

Standards of translation quality will decline as long as sloppiness, whether generated by the machine or the human, is tolerated.

Raw, unpostedited MT should not be a threat to translation standards. It is not intended to replace translation and can be used for purposes that are beyond human capacity in terms of speed, volume, and reduced cost. It should be recognized that sometimes a picture-perfect translation is unnecessary. MT is assuming an increasingly important role as a processor or “information-only” drafts. Some users—for example, most of the 1,600-plus analysts served by FASTC at Wright-Patterson Air Force Base, who plug into MT on-line, are willing to settle for unpostedited raw output (Vasconcellos and Bostad 1992). In a study conducted at Sandia National Laboratories, 34 of 41 analysts found raw MT output acceptable for their purposes (Newman 1988). At the European Commission, 70% of the 30 million words of MT churned out annually is for immediate use by managers and others outside the translation services.<sup>9</sup>

Part of this information-only volume may be for spotting texts that need to be fully translated. Several of the respondents in the IAMT survey reported that they use MT for triage, to decide whether or not to send a job out for a full translation. In the end, the proliferation of raw MT should underscore the importance of human translators, and generate more assignments for them, because the distinction between the machine output and what a person can do will become patently clear to all.

• MT WILL CONTRIBUTE TO THE PUBLIC'S POOR UNDERSTANDING OF THE TRANSLATION PROCESS; TRANSLATION CONSUMERS WILL EXPECT MIRACLES.

Nontranslators are largely unaware of the translation process and the complexity that it entails. Unfortunately, the widespread availability of MT for personal computers has raised unrealistic expectations in the public mind. Many people who need quality translations turn to MT in the hope

that it will spare them the cost of a proper professional product. This kind of thinking does a great disservice to the profession. It may well be MT's darkest legacy.

Translators need to join forces in an unrelenting effort to inform the public about the real nature of translation. However, such a campaign must be credible. It needs to take into account the role that MT can play, rather than denounce it, especially with inaccurate claims and statements. A shrill attack against MT is often perceived by people outside the profession as a defense of vested interests and outmoded working methods, and as such it tends to be discredited.

• MT IS BEING USED BY PEOPLE WHO DON'T KNOW MUCH ABOUT TRANSLATION.

It is true that more and more people outside the profession are getting involved in translation. While MT is contributing to the trend, the underlying cause is the mammoth growth in localization. This relatively recent development, even though it means that more translation is being done in the world, has a down side for translators, for it has meant that MT is being used increasingly by nontranslators and that in some cases decisions are being made by managers who lack knowledge about the translation process and may not be able to judge the product they're getting. As the translation market gravitates toward areas in which profit margins are tighter and speed of delivery makes a big difference in the bottom line, managers are driven to look for economies wherever they can find them, and MT becomes very attractive. It promises a fully automated publishing chain with large savings in the porting of formats, accurate carryover of numerals and formulas, uniform terminology, and faster turnaround, to mention a few advantages. In addition, postediting is typically compensated at lower rates than full translation—from *really* low rates up to a maximum of about 70%—and nontranslators are willing settle for less. Moreover, they are eager to give it a try, whereas regular translators don't always want to do this kind of work; they would rather not devote their career to a project involving, say, 100,000 pages about the innards of a telephone switching system (a true case in point). As a result, recruitment is increasingly directed outside the translation profession. And because translators are often absent from this market, the agencies that do employ them may find themselves at a disadvantage when they try to bid for jobs.

At the same time, it is safe to assume that good, experienced professionals will always play a major role wherever sensitive translations are

needed—translations that will be closely scrutinized or published and read by a large audience.

- MT PRODUCTS ARE CONFUSING; PRICES RANGE FROM 80 TO 50 TIMES THAT MUCH.

MT products *are* confusing. It is beyond the scope of this essay to explain the differences between the various types of MT systems and platforms,<sup>10</sup> but with any system the translator needs to bear in mind a basic set of principles which ensure that its use is maximized.

Since MT is not always cost-effective, independent translators should approach it with caution. It involves an up-front investment to buy the software, and sometimes the hardware, and to build up the dictionary to meet the user's own requirements, which may take from three to six months (Vasconcellos 1993b). These investments will be justified if costs can be trimmed over the long term. Much will depend on having a large and steady volume of input text (probably at least 100,000 words a month) that is straightforward in style with a minimum of ambiguity and preferably in a single domain. The other conditions described in the preceding sections are also essential. Barbara Thomas, the freelance medical translator who achieves productivity increases of 25% to 50%, sums it up: All MT programs present the translator with similar problems: (1) the original must be not only machine-readable but well-written and checked for spelling and grammar; (2) the skills for postediting MT output must be developed; postediting requires a great deal of mental effort; and (3) don't count on enormous increases in productivity overnight.

### *Conclusion*

Appreciating MT is a question of balancing the pros and cons and the pluses and minuses. If the arguments above have seemed contradictory and confusing, it's because they are. Even veteran users get confused. There are many variables to examine, juggle, and trade off, and the variables themselves are fraught with conditions, complexities, and inconsistencies. In the whole picture, perhaps only one conclusion can be reached without qualification: MT is here to stay.

The professional associations have an obligation to provide the briefings and detailed training that will help translators adjust to working with MT, and it is up to translators themselves to take an active role in imple-

menting it so that it leads the profession forward rather than into dark alleys and up dead-end streets.

#### NOTES

<sup>1</sup> In 1960, at hearings before the Special Investigating Subcommittee of the Committee on Science and Astronautics of the U. S. House of Representatives, John J. Bagnall of the Central Intelligence Agency testified that the Russian output of scientific information was 780 million words a year, 53 million (7%) of which was being translated by the intelligence community. In 1993, according to speakers at the Symposium on Advanced Information Processing and Analysis (2-4 March), the intelligence community faced the challenge of sifting through a volume of 150 billion words, now in a variety of different languages.

<sup>2</sup> Respondents were asked to provide their ATA membership number, a requirement which effectively limited coverage to ATA members and at the same time precluded duplicate returns from any one individual.

<sup>3</sup> Information provided directly by Environment Canada in Response to IAMT survey (results published in Vasconcellos 1993).

<sup>4</sup> Dale A. Bostad, FASTC, personal communication, January 1993.

<sup>5</sup> In the IAMT study, 23 users reported their annual MT translation volume: together, they produce 170 million words a year, and of this total volume, 108 million, or 64%, is for localization. It is interesting to note, by the way, that of the total study population of 40 MT users, 80% started to use MT in the last five years. (All data from Vasconcellos 1993.)

<sup>6</sup> The author, formerly the chief of translation and terminology at the Pan American Health Organization in Washington, D.C., speaks with authority on this issue, having postedited several million words of machine translation in a large range of subject areas over a period of 14 years and having worked with over 50 posteditors.

<sup>7</sup> Responses received in the IAMT study, including some not reported in Vasconcellos 1993.

<sup>8</sup> From a CompuServe thread, August 1993.

<sup>9</sup> Response received in the IAMT study.

<sup>10</sup> Summary information on PC-based MT systems is available from ATA Headquarters (1735 Jefferson Davis Highway, Suite 903, Arlington, Virginia 22202-3413). *Byte* magazine had a state-of-the-art section on MT for PCs and workstations in January 1993 (see especially "Babelware for the Desktop" by L. Chris Miller). For more technical background on MT systems, see Hutchins (1986), Hutchins and Somers (1992), Vasconcellos (in press). The Association for Machine Translation in the Americas (655 Fifteenth Street, N.W., Suite 310, Washington, D.C. 20005) provides a bibliography on the practical use of MT.

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