Probing the translation process

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1. Translation and the computer

As we are entering the new millennium, most translation is done *on* computers, though not *by* computers. Despite five decades of intensive machine translation research, the majority of translation in the world is still not done by machines but by human translators. However, in making their translations nearly all human translators use computers one way or the other, and it is worth reflecting on the nature of this man-machine interaction, before moving on to looking at a new way of using the computer, viz. to monitor the process of making a translation.

There are three main ways in which translators are now using their computers. One way is for the translator to use the computer's text-processing and database-querying capacity. Another way is to have the computer assist the translator by suggesting translation equivalents, which the translator can insert into the translation or ignore. Finally, translation can be done automatically so that the translator does not come into the process until after the machine has attempted to do a complete translation of a text.

Writing translations on a computer

In most cases, the fact that translation is done on a computer does not radically change the way in which translations are made. In fact, we might say that translation is still often done *at* a computer rather than *on* a computer, since the computer does not play an active role in producing the translation. It merely functions as an electronic typewriter on which translations happen to be written, and there is no particular reason, i.e. no translational reason, why this should be so. The computer is used because translation involves text production, and – at least for professional purposes – electronic text production has now almost completely replaced older writing technologies. With electronic text there is a double gain for the translator. Time can be saved because editing electronic text is easy and fast, and the quality (or at least the finish) of the target text can be improved because strong formatting and proofing tools are easily available.

These gains are differences of degree, however. The change of technological platform does not by itself entail a radically new production situation, and yet the effect on translation is quite considerable. In fact, the new technology

impacts on all the main phases of the translation process. It affects the way source texts are read, the way target texts are produced, and the ways in which necessary and relevant information is accessed.

The increasing use of electronic text clearly affects the way in which translators read and refer to source texts. Whereas, formerly, a translator would typically translate from a printed paper copy of the source text, it is becoming increasingly common that translators do on-screen translation. That is to say, either the source text is read in one window and the target text written in another window, or the translator overwrites the screen copy of the source text as s/he translates. Since a translator's attention constantly has to shift between the source and target texts, and perhaps reference texts as well, time can be saved if source, target, and reference texts can be kept close together. And time saved on reading and referencing texts can be invested in other processing activities, such as source text comprehension, retrieval of background information, and target text editing. Therefore, at least in theory, the new technology ought to result in better source text comprehension and better target texts.

Once target text production takes place by means of a computer, the translator can take advantage of all the editing and proofing tools that come with modern text processing. The computer makes it very easy to change text after it has been typed, and such proofing tools as spell checkers or grammar checkers also facilitate text production. Writing time can also be saved because the computer makes it easy to copy strings of text from source and reference texts into the target text. Overwriting the source text has the additional advantage of minimising the risk of accidentally skipping chunks of source text.

However, though such tools clearly change the editing conditions of text production, and therefore also affect the editing of target texts, they still do not radically alter the conditions under which translations are produced because editing and proofing tools do not assist authors with actual text creation. A human author or translator still has to think up the text before the computer can begin to correct it.

Similarly, the power of the computer to recognise, store, and retrieve text strings, to query electronic dictionaries, term banks, and large amounts of free or structured text for relevant information, can save time and add quality to a translation. On-line access to the translator's most cherished tool, bilingual dictionaries, helps speed up and improve translation, as does on-line access to terminological databases, parallel text corpora, and encyclopaedic reference materials. Access to the infinitely rich though sometimes rather unmanageable resources of the internet very often allows the translator to find highly

specialised information needed for a certain translation task and not easily found in traditional encyclopaedias.

Using the computer to assist with translation

In the instances so far described the computer has played and integrated the roles of desktop, typewriter, dictionary and encyclopaedia. It has probably made the translator's work both easier and better, and at every point the translator has been in full control. The computer has been used to assist with getting the spelling of a word right, with looking up words in dictionaries and termbases, and with finding information on the internet, but the entire translation has been created, sentence by sentence, by the translator.

The nature of the interaction between translator and machine can be different, however, as when the computer is programmed to play a more 'active' role in the production of a translation. More and more, translators are using dedicated translation software to assist them with making a translation. And increasingly this practice is changing the way translators tend to work. When dedicated translation software is used, i.e. when software programs are used that have been developed specifically for the purpose of automating or otherwise facilitating the translator's work, the computer more obviously takes on the role of assistant to the translator. Translation software is available that makes the computer look up source text words in a dictionary automatically and display the findings on the screen so that translation equivalents are always to hand, should the translator need them. Translation memory systems are programs that store source text sentences together with the translations of them made by the human translator. When the translator enters a new source text for translation, the translation memory system will scan the text, search its database of translated sentences, and display all the matches found. This saves a lot of time for translators (and companies) working with fairly stereotyped texts (or updates of texts), because any sentence that has already been translated will no longer need to be retranslated by the human translator.

So-called 'interactive' translation systems go one step further in that they not only look up source text words automatically but attempt to analyse source text sentences (through some sort of 'parsing') and propose a translation. The interactivity of such programs consists in the fact that, for each sentence, the program waits for the human translator to accept, reject or alter the computer's suggested translation. It might appear that the roles of machine and translator have now been reversed, that the translator can sit back and fairly passively just monitor the activity of the machine, but in fact all target text is still decided by the translator. The computer comes up with suggestions, but everything still has to be accepted by the translator before it is allowed into the target text.

Some systems, such as Trados' Translator's Workbench, bring the various facilities together in one system, so that dictionaries can be accessed, source texts can be analysed, and translation memories can be scanned from within the program in which the target language text is processed.

Automatic machine translation

Such 'interactive' translation systems are different from fully automated translation systems, which do 'batch' translation. With fully automated machine translation, the program does not wait for a human translator to accept or reject each sentence. The machine outputs a translation of the entire source text, which may have been fed to the computer either automatically or by a person without any translation skills. The translator does not have to be present at all while the machine is doing its work. However, translators still often interact with fully automated translation systems, as pre-editors or post-editors, or as translation experts providing feedback to programmers. Therefore, in a way, this method of organising man-machine interaction around translation is no less interactive than with the interactive systems.

The distinction sometimes made (e.g. in Hutchins & Somers, 1992:149-151, and Trujillo, xi) between machine-aided human translation (MAHT) and human-aided machine translation (HAMT) should be seen in this light. They are two different (but not all that different) ways of organising translation. One way is to produce the target text sentence by sentence, with the human translator monitoring production sentence by sentence. The other is to have the computer come up with a complete translation bid first, and then have the translator come in and post-edit, revise or monitor the entire translation subsequently. The difference between the two methods is perhaps most striking if – as is now the case with several of the automatic translation services available on the internet – the computer's output is made available to the end-user without the intervention of a human translator.

Translation technology of the near future

Machine translation algorithms are constantly being improved, and translation memory systems become more and more powerful. Other technologies that I believe could well affect translation considerably in the not too distant future are (a) speech recognition and (b) on-line feedback systems.

(a) Speech recognition
Once we are able to program the computer to process connected speech accurately, translators can dictate target texts instead of having to type them. This also means that spoken input can be instantly processed and presented in

writing to an interpreter.[1] Thereby the work of translators and interpreters will become more similar. Both will probably prefer to produce their target text orally. On the reception side, interpreters will have access to an instantly generated written transcript of the spoken source text in addition to the spoken source. In an emergency, a simultaneous interpreter would therefore be able to work only from such a written source, making the interpreter's work identical with the translator's in terms of language modality.

(b) On-line feedback systems
The advent of computerised language technology has made it possible to introduce a number of feedback or monitoring functions to assist writers in their text production. Spell checking is an example. Not so long ago, a spell-checker was a separate program in a word processor, which operated off-line. A writer would activate the program when s/he wanted a text to be checked. Now, spell-checkers are usually constructed to provide instant, on-line feedback if a typing error is made.

Feedback serves a dual purpose: it strengthens learning and enhances performance. An aeroplane pilot can estimate his altitude and speed by looking at the earth and getting visual feedback, but feedback from reliable instruments will both provide him with more exact information and sharpen his ability to estimate altitude and speed accurately. For most process purposes, on-line feedback is preferable to off-line because on-line feedback allows the performer (the pilot or the translator) to make adjustments during the event. Off-line feedback, coming after an event, does not help the performer to make corrections during the event. On the other hand, off-line feedback may have stronger long-term effects because it can be repeated and studied separately from the turmoil of the event.

The *Translog* program, which I shall now turn to, was not originally intended to be a translation feedback system. It was designed as a research tool for studying the writing process in translation. It has appeared, however, that it might also be useful as a learning tool, and the further perspective is to develop it into an on-line feedback system.

[1] If speech recognition and machine translation could be combined successfully, it would of course be possible for speakers of any language to communicate without the intervention of an interpreter or a human translator. Cf. the brief for the German *Verbmobil* project (Kay *et al.*, 1994).

2. Probing the translation process with *Translog*

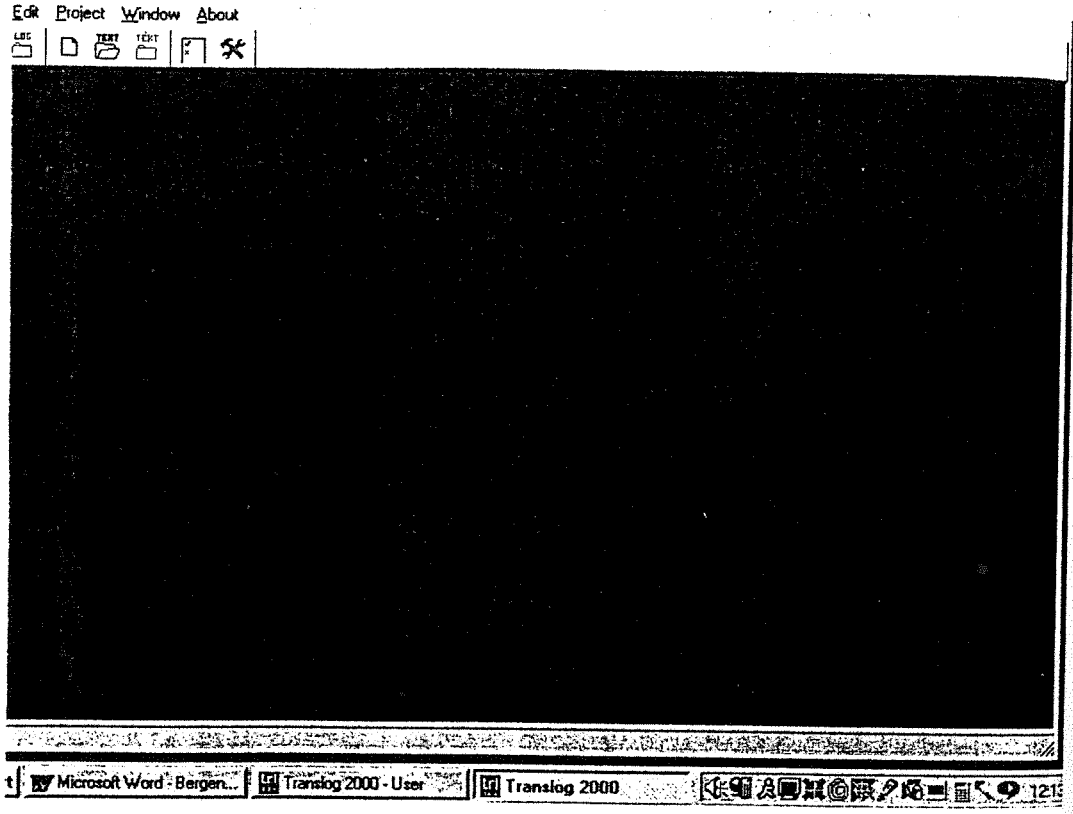
There are three main purposes for which people who research translation are interested in developing tools for studying or 'probing' the process of translation. One is a purely scientific purpose. If we can develop better tools for studying the process of translation, it is fair to assume that we will be in a better position to understand the phenomenon of translation better. A second purpose, partly derived from the first but more practical, has to do with the teaching of translation. If we develop better tools for observing, recording and displaying translation processes, and if we improve our understanding of the process of translation, we should be able to teach translation more efficiently. The third main purpose reaches into the professional and practical world of translation. A tool for observing, recording and displaying translation processes is useful not merely for research purposes but can be applied to actual translation, by supplying translators with either on-line or off-line feedback that will enhance their translation performance and strengthen their overall translation competence.

Translog - *the program*

Translog was designed in 1995 as a research tool for studying the writing process in translation.[2] The version used from 1995 to 1999 was a DOS version (documented in Jakobsen & Schou, 1999)[3]. The version illustrated in the present article (*Translog 2000*) is a new Windows version. For translators used to working in a Windows environment, the program interface has a more familiar look, and there are a number of other advantages though the essential functionality of the program remains the same. Like the original *Translog*, *Translog 2000* is really two programs, a User program and a Supervisor program. The Supervisor program contains an editor for editing source texts and a facility for setting up the User program to display the source text in various ways. The User program displays a source text in the manner specified, and when somebody types a target text, it logs what keys are struck at what moment. The information logged in this manner is saved in a file. Subsequently the Supervisor program can represent the data either as a linear succession of all the keystrokes made, interspersed with symbols (asterisks) indicating time, or they can be replayed dynamically as a kind of video showing how the target text was created.

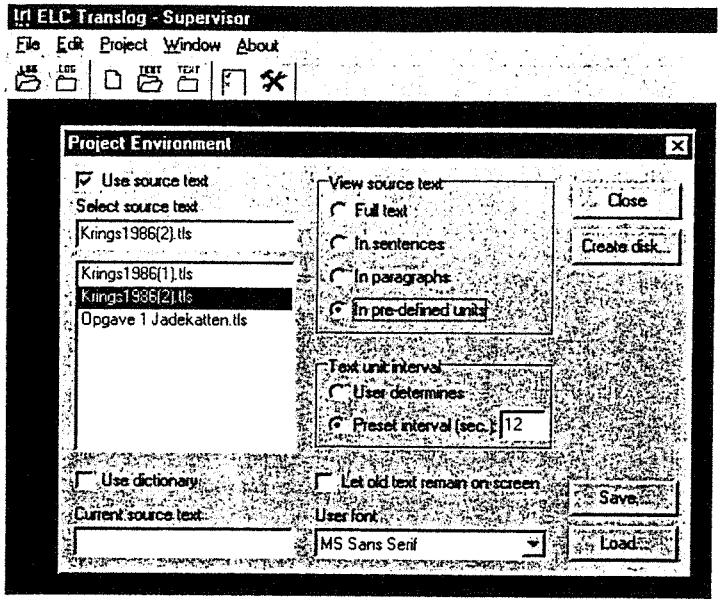
The Supervisor interface currently looks like this:

[2] See Jakobsen (1999).
[3] The documentation for *Translog 2000* has yet to be written.

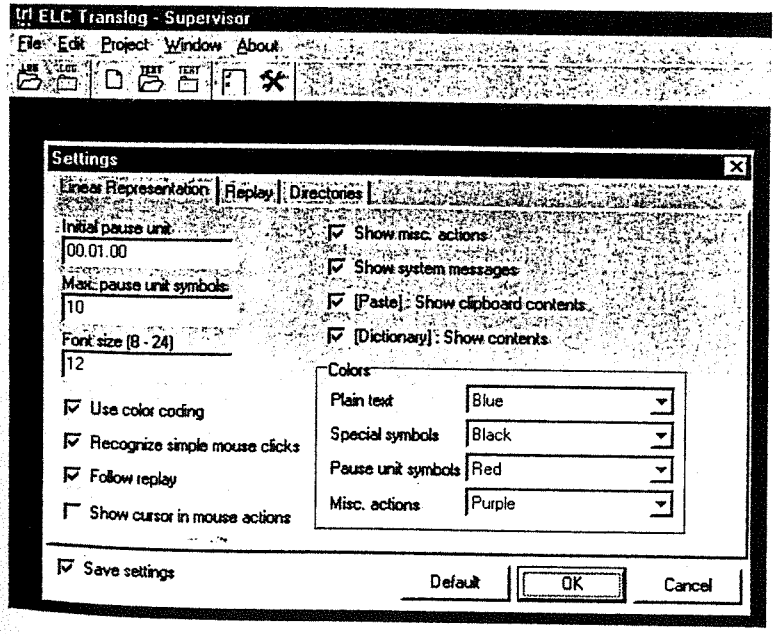


From the File menu it is possible to open and close log files, to open the source text editor, and to open or close existing source texts. Alternatively, the appropriate icons can be clicked.

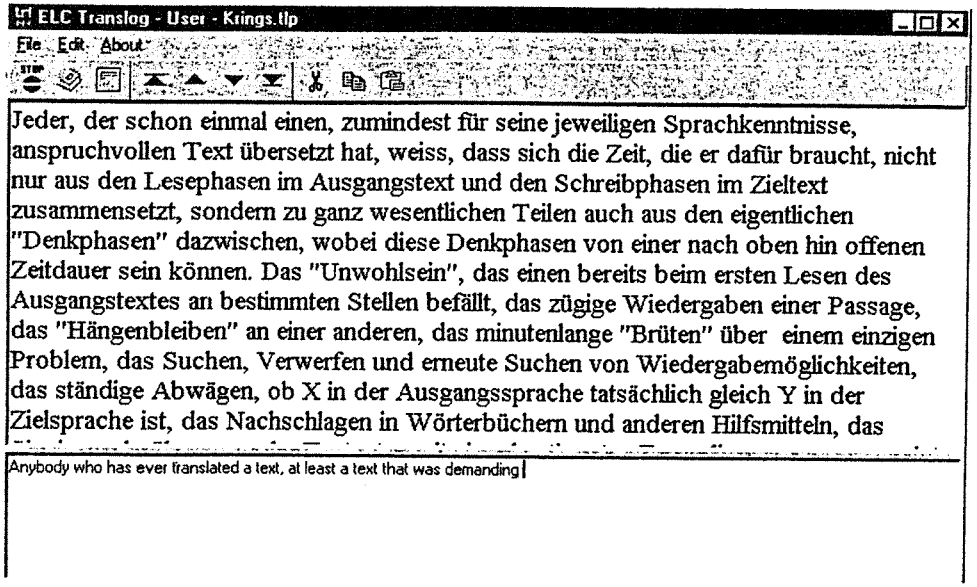
The Project menu (or the Project icon) makes it possible to create a project environment, which is a package of instructions telling the User program which source text to display and in which manner:



Finally, the Settings icon makes it possible to manipulate the linear representation and the replay function in various ways:



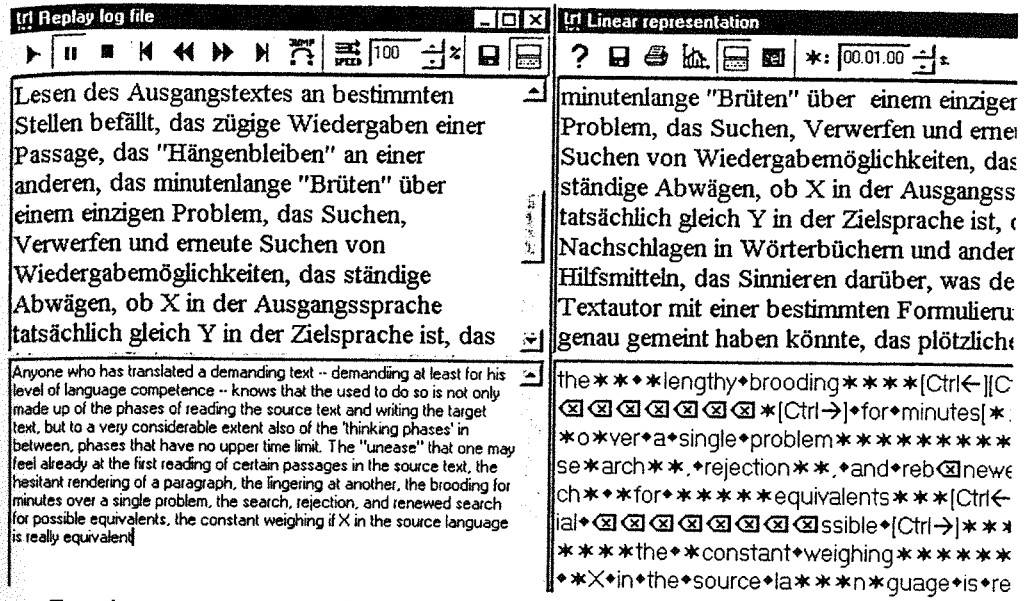
A translator participating in an experiment will be asked to open a project in the User program. On pressing a Green Flag icon (not shown here), the logging of time delay and keystrokes begins. The source text will be displayed in the upper window, and the translator's target text will appear in the other window. Since *Translog 2000* is a Windows program, it is possible to access other programs, electronic encyclopaedias, the internet, etc., and to copy text from such sources to the clipboard and paste them into the target text.



At the end of a translation, the Stop button can be used to terminate the logging function, and the translator will be asked to save the log file.

Once a log file has been saved, the Supervisor program can be used to display the logged data either in a linear representation or dynamically, or both at the same time (with or without the source text). The linear representation not only includes all the standard keystrokes but also includes symbols for cursor movements, carriage returns, backspaces, etc. Furthermore, a number of asterisks indicating time will be printed. This means that it takes a little practice to read this representation. If the time value assigned to the asterisk variable is greater than the default value of 0.5 seconds, the number of asterisks will be smaller than in the standard representation, and the text will look more like a normal text. Conversely, if the time value assigned to the asterisk variable is

smaller than the default value of 0.5 seconds, the number of asterisks will increase and legibility decrease.



Translation process research

The main purpose for which *Translog* was developed was translation process research. The aim was to create an instrument that would automatically and faithfully record all the writing and editing that went into creating a translation, and which would accurately record time delays between individual keystrokes. If time delay between keystrokes was recorded, it would be possible to calculate delays between larger segments like works, sentences, or translation units, and such time delay observations would be an interesting reference background for a theory of translation processing. In any case, we would learn more about the temporal aspects of translation, the speed of expert translators compared with that of novice translators, the speed of professional translation compared with the speed of professional interpreting, or the effect of time pressure on translation. We might be able to find out what translation problems require the most processing time and find new strategies for minimising delays. We might be able to identify translator profiles by studying the distribution of delays or the styles of revision. All in all, the idea was that a research tool that would help us to see the typing process in translation more accurately would help us understand the translation process better.

Data recorded by the computer would also function as a supplement to the kind of qualitative data that most translation process studies since the mid-1980's had been based on. The method employed in Krings' study from 1986 *Was in den Köpfen von Übersetzern vorgeht* and numerous subsequent studies (e.g. Séguinot (1989), Lörscher (1991), Fraser (1996), Jääskeläinen (1999)) was inspired in particular by Ericsson & Simon's description of think-aloud methodology in "Verbal Reports as Data" (1980) and in *Protocol Analysis* (1984; 1993). Though many objections have been made against some of Krings' methodological decisions, his overall design, I believe, has set the standard for most translation process research undertaken since 1986. The main elements in the approach are well known. There will be a carefully thought-out research design that has been tested in pilot projects. For the main experiment(s), subjects will be carefully selected, and the experimenter will have detailed knowledge of their background and translation experience or will have pre-tested their skills and knowledge. Warm-up exercises and controlled instruction of subjects in the main task(s) of an experiment will help eliminate random data elicitation. The core of such experiments has typically been a combined translation and think-aloud task, which has been audio or video recorded. In experiments of this kind, the crucial data about translation processes therefore derive from (a) recordings of the process of writing the target text and from (b) the recorded think aloud data. Sometimes further data sets have been elicited, e.g. in retrospective interviews immediately after completion of the translation and think-aloud task or from questionnaires filled in either before or after the core component of the experiment. Subsequently all of the data have been transcribed according to carefully motivated and explicit transcription principles. And only then has the researcher embarked on the most demanding process of all: the attempt to make sense of all the data through analysis.

Krings' survey of the phases in his own main experiment was as follows (Krings, 1986:58-59)

I. Vorbereitung der Datenerhebung

Grundidee: Lautes Denken
↓
Selbstversuch
↓
Genauer Zuschnitt der Verbalisierungsaufgabe
↓
Auswahl der Versuchspersonen
↓
Auswahl der Texte
↓
Probelauf mit einer Versuchsperson
↓

Verbesserung des Designs (z.B. Farbsystem)
↓
Entwicklung des Fragebogens für die übersetzungsbezogenen Hintergrundinformationen

II. Durchführung der Datenerhebung

Schaffung einer entspannten und sanktionsfreien Atmosphäre
↓
Erklärung der Aufgabenstellung
↓
warming-up phase
↓
eigentlicher Übersetzungsversuch
↓

III. Aufbereitung der Daten

Festlegung der Transkriptionsnormen
↓
Vollständige Transkription der Tonbandaufzeichnungen zu LD-Protokollen

The research designs used in the Copenhagen Business School translation project are heavily indebted to Krings' methodology. The main difference is that the Copenhagen approach has been multi-methodological. While recognising the value of qualitative data elicitation and analysis, we believe stronger hypotheses can be formulated if they are based both on qualitative and quantitative, machine-recorded data from the same translation events (cf. Jakobsen, 1999). The typical design of experiments combining keystroke logging in *Translog* with think-aloud has looked like this:

I. Preparation of experiments
1. Identification of research problem
2. Formulation of initial assumptions (hypotheses) about problem
3. Initial design of experiment
   - what variables? (independent and dependent)
      - what kinds of text?
         - level of complexity?
         - level of LSP-ness?
      - what kinds of subject?
         - non-professionals?
         - semi-professionals?
         - professionals?
         - experts?
      - what kind(s) of translation task?
         - direction L1 or L2?
         - medium -- oral or written (penned, typed, keyed)?
         - time available for task? (time pressure?)
         - access to reference material? (dictionaries, encyclopedias,

parallel texts, internet)
- how many texts, subjects, tasks -- and in what order?
- what method(s) of recording?
- what measurements?

4. Selection of texts and subjects for translation task
5. Pilot project to test initial design
6. Revision of initial design (if required)
7. Pre-testing of subjects (tests, interviews, questionnaires)

II. Running and recording experiments
1. Laboratory ecology (test situation & real life situations)
2. Instruction
3. Warm-up exercise
4. Audio/video/computer recording of translation-with-think-aloud tasks

III. Transcription of data from experiments
1. Transcription of think-aloud recording (what said? where paused? what grunts and gestures?)
2. Synchronisation of computer-logged data and recorded think-aloud data (typing process data and spoken/visual data)

As can be seen, we believe there is a close connection between the problem a researcher proposes to investigate and the way experiments aimed at eliciting relevant data about the problem should be designed, but in general the design closely resembles that of earlier experiments. The main difference is that we have added a new data source to the design, and since our method draws on process data from different aspects of the translation process (think-aloud and typing activity, respectively), we have also had to find ways of accurately synchronising our data.

Research applications

Several of the research purposes that the *Translog* program has been used for are documented in G. Hansen, ed. *Probing the process in translation: methods and results* (1999). In addition to some methodological reflections (by M. Pilar Lorenzo and A.L. Jakobsen), the volume includes studies of the translation strategies employed by semi-professionals (G. Hansen) and professional translators working under different time constraints (A. Jensen). There is a study of decision-making strategies used by professional translators when translating into a foreign language (M. Pilar Lorenzo), a study of the effect of source text complexity on translation (E. Halskov Jensen), and a study of the effect of dictionary access on translation (I. Livbjerg & I. Mees).

Keystroke logging gives us information about a number of mundane aspects of the writing process in translation. It tells us perfectly accurately what corrections were made along the way, and how much time it took a translator to negotiate a

specific problem. This is valuable information though of course more corrections may have been contemplated than are recorded in a keystroke log. More generally, *Translog* also shows how fast or slow translators are. Traditionally, speed has not been valued as highly, and therefore not studied as intensively, in translation as in conference interpreting. A conference interpreter, we know, can easily process 100 or even 120 words per minute, whereas translators are said typically to produce only about five words per minute (Bell 1998, 186). What immediately appears from keystroke logs, however, is that there are enormous variations in the speed with which translators work, both within the same translator, and across different translators. The fastest translator we have measured had an overall output of 7.5 words per minute, but this was in a text that caused her to pause relatively frequently. Her peak performance over one sentence was 26 words (including 4 words that were deleted during the writing of the sentence) in just over 20 seconds, bringing her production speed up to 78 words per minute. Though this is still a good deal less than the simultaneous interpreter's maximum working speed, and was maintained across one sentence only, it does suggest that translation is not inherently 20 times slower than interpreting. If translators were able to introduce more interpreting strategies into translation, a lot of time could be saved.

Other possible research applications of *Translog* (with or without concurrent think-aloud) would be to study 'chunking', the way in which translators build their translation from segments of text sometimes referred to as translation units. How different are novice and expert chunking? What is the relationship between chunking and the quality of the target text and on the speed with which it is made? An interesting methodological project would be to use *Translog* to find out to what extent translation (the translation process) is affected by the requirement to think aloud.

Translog *as a translation learning tool*

As we ran our experiments, several of our translator subjects said they felt they would be able to improve their translation performance by studying *Translog* representations of their own translations. In the original conception, *Translog* was a research tool designed to help us get more certain knowledge of the translation process so that we would be better able to teach the process to students. But the response we got from subjects suggested a new direction for the future development of the program. Instead of developing the program's potential as a research tool, we ought perhaps to think in terms of developing its potential as a learning instrument.

Though the 2000 version makes the program a great deal easier to use for most people in addition to making it more powerful and flexible, its potential as a

learning instrument is still not well developed. It functions well as a translation process demonstration tool. The replay option is a kind of mirror, in which translators can study their performance repeatedly, but only after the event. However, access to the mirror is likely to reinforce a translator's recollection of former translation events and therefore might well provide useful, long-term feedback, and by studying and cataloguing personal translation stumbling blocks, a translator will no doubt be better able to discover appropriate strategies for overcoming them.

As it stands, the program can also be used to compare translation events. Novice translators might compare their own writing processes with those of expert translators, or translators might compete (on speed) against each other or against their own earlier translation events.

Translog *as a translation tool*

A further perspective is to develop *Translog* into a tool that will assist with translating by allowing translators to monitor their own translation process on-line. The feedback currently provided by *Translog* can only be accessed off-line, but in order to make the program more directly useful to translators, it will have to be able to give on-line feedback.

On-line feedback could take many forms. There might be an array of feedback possibilities, which a translator could choose to enable or disable. There might be feedback on such process features as writing speed, corrections made, dictionary look-ups, and pauses exceeding e.g. 4 seconds. Simple counts could be made of keystrokes per time unit or target text characters per time unit, and an on-line log might be available of what corrections had been made, what words had been looked up in dictionaries, what contexts had caused long delays. In the current *Translog 2000* version, the log file records text pasted from the clipboard, but it does not trace the provenance of such text beyond the clipboard. A future version might include on-line feedback about the web sites and other external information sources a translator had accessed while making a translation.

3. Conclusion

The interaction between human translators and their wonderful writing machines will continue to develop. On-line translation-relevant feedback would clearly enhance the translator's performance because it would make stronger self-monitoring possible. It would enhance translation performance and reinforce learning. If a feedback system were integrated with the other components of a translator's workbench, the result would be a very strong translation support

system. Certainly not one strong enough to compete on speed with machine translation systems, but strong enough to enable expert translators to produce translations faster and with better quality than is possible with current technologies and working habits.

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