

Using Think-Aloud Protocols to investigate the translation process: methodological aspects

Silvia Bernardini

University of Bologna

In the last decade, Think Aloud Protocols (TAPs) have become a major instrument in process-oriented Translation Studies (TS). However, the serious questions regarding the experimental validity of this research methodology when applied to the translation process has been systematically reviewed in the literature. Theoretical justifications have been imported from psychology and related disciplines without questioning their applicability to the new experimental settings, and the validity of the method as a whole has been assumed rather than proved. This paper surveys the breakthroughs as well as the limits of the growing body of literature dealing with TAPs in TS, and points at the necessity to take issues of experimental, theoretical and environmental validity more seriously. A pilot study is described which attempts to address some of these issues, at the levels of experimental design/administration, data analysis and report. It is claimed that the risks involved in the adoption of a lax experimental methodology in TAP studies have been underestimated in the past, and that the generalised lack of concern with it can invalidate not only the results obtained in the single projects, but the validity of the approach itself.

Introduction

In recent years the study of translation has undergone a considerable shift of interest away from prescriptive and rather anecdotal attitudes, towards more descriptive, scientific positions. One of the consequences of this shift of interest has been the increase in empirical research into the translation process. This was driven by the belief that what goes on in the translator's head while s/he is translating (versus what scholars had claimed might go on) is at least as crucial to the understanding of translation as a comparative analysis of the final product, the translated text, in relation to the source text. For a number of reasons that will be discussed below, the translated text provides a very incomplete and often misleading way into the translation process, hiding both successful strategies and problems.

Insofar as it is not possible to directly observe the human mind at work, a number of attempts have been made at *indirectly* accessing the translator's mind. One such attempt, which has been steadily gaining ground in translation research, has been to ask the translators themselves to reveal their mental processes in real time while carrying out a translation task. Such a method of data collection, known as 'thinking aloud', is not new to scholars working in psychology and cognitive science. However, insofar as its use in translation studies has only recently begun, its specific implications are still relatively understudied, and the research methodology employed somewhat lax.

The aim of this paper is primarily methodological. First of all it provides a survey of the available literature on think-aloud protocol (TAP) experiments in translation, in order to offer the reader a summary of the achievements, prospects and limits of this body of research. Building on this discussion, it subsequently reports on the preliminary stages of a TAP experiment recently conducted, which was designed as an attempt to tackle some controversial issues relating to this procedure of data collection and analysis. Even though the results reported on here are still provisional and largely inconclusive, this pilot experiment is meant to be a step forward in the setting up of a more rigorous research methodology than has

so far been employed in translation studies, as well as a contribution to the ongoing reflection on the nature of research into the translation process.

TAP: A Survey

The theoretical grounding: Think-aloud in psychology and cognitive science

The theoretical framework for TAP experiments is provided mainly by the work of Ericsson and Simon¹ (esp. 1993 (1984)). In their influential book, these scholars work with a model of human cognition as information processing. According to this model, information is kept in different memory stores, with varying access and storage capabilities: whereas short-term (STM) is characterised by easy access and severely limited storage space, long-term (LTM) memory is characterised by more difficult access and larger storage space. Only information present in STM, that is information which is being heeded by the subject (static and conscious ‘knowledge states’ rather than dynamic and unconscious cognitive processes), can be directly accessed and reported. This distinction is crucial because the cognitive processes to which these knowledge states are inputs and outputs, as well as information that is not currently being heeded, cannot be reported but must be inferred by the analyst on the basis of the verbalisations. A further assumption of this model is that, for verbally encoded information, which can be reported in the same form as the one in which it was heeded, the verbalisation does not interfere with the cognitive process, the only effect of thinking-aloud being to slow down the performance. The implications of this model are manifold. Here we shall only consider those relevant to our discussion.

First of all, only *concurrent* verbalisation of thoughts can be claimed to exhaustively reflect the mental states of a subject carrying out a relatively long task (‘which takes longer than ten seconds to complete’, according to Ericsson and Simon). On completion of such ‘long’ tasks, part of the information moves on to LTM, leaving behind retrieval cues only in STM: in such cases, post hoc verbalisation has been found to be difficult and often incomplete (Ericsson and Simon, 1993 (1984): xvi). Moreover, ruling out the possibility that a subject is interpreting her/his own thought processes or even generating them anew, instead of retrieving them from LTM, can be extremely problematic under these circumstances.

Secondly, in order to make sure that the reports actually reflect mental states without distorting them, it is important that the subject does not feel s/he is taking part in social interaction: albeit obviously a much more natural situation, conversation involves reworking thoughts to make them conform to socially established norms, a process which might sensibly alter the information attended to. The interaction between subject and experimenter (or between subjects) should therefore be avoided or at least reduced to a minimum.

Thirdly, practice and experience may affect the amount of processing carried out in STM, so that fewer mental states will be available for verbalisation to subjects experienced in a task. This process, known as ‘automation’, is explained by Ericsson and Simon (1993 (1984): 127) thus: ‘...before overlearning has occurred, processes have to be interpreted, with substantial feedback from intermediate processing stages in STM. Overlearning amounts to compiling these processes, so that fewer tests are performed when they are being executed, hence less information is stored at intermediate stages in STM.’

Automatic processes are therefore faster and more efficient than processes which are under conscious control. However, they are also less flexible and more difficult to modify at need.

¹ A discussion of think-aloud as a method of data collection exceeds the scope of this paper: the interested reader is referred to the extensive discussion and reference list provided by Ericsson and Simon (1993 (1984)).

Finally, this model takes into account the effects of personality and personal history over the data collected through TAPs. The amount of relevant information held in LTM cannot possibly be controlled for, as an experimental situation would require, nor is it possible to control for the amount of knowledge reported on in relation to the performance given. In other words, there exist individual differences in knowledge and capacity to verbalise thoughts that can heavily bias the data obtained. Clearly, the problem here is one of object of study rather than methodology: individual differences exist, and research should not conceal them. However, it seems advisable to try and limit the effects of individual differences as much as possible, and to take them into account during the analysis, in order to obtain more reliable and generalisable data.

Summarising the present argument:

- Concurrent verbalisation, or thinking aloud, provides data on the mental states heeded by individuals carrying out a task.
- From these states it is then possible to derive information about the relevant mental processes.
- Under the right circumstances (verbally-encoded information, no social interaction, no interferences, no instruction to *analyse* thoughts), verbalising is assumed not to interfere with the mental processes and to provide a faithful account of the mental states occurring between them.
- The generalisability and the relevance of the data obtained through TAPs, however, is more difficult to assess, and cannot be guaranteed by the model itself.

TAPs in Translation Studies

Achievements

Viewing translation mainly as a problem-solving process, some scholars have put forward the suggestion that it should be possible to study it by means of TAPs, and have set up experiments to test this hypothesis. The varying interests and backgrounds of those involved have resulted in a large variety of approaches, which can only briefly and unsystematically be surveyed here. In this sub-section the achievements of the last twelve years in TAP studies are considered. In the following the inadequacies observed are commented on and ways of proceeding in the future suggested.

Most early TAP studies were conducted with foreign language learners or translator trainees. This was mainly due to the availability of subjects and to the pedagogic concerns of the experimenters. However, the hypothesis was also put forward that the verbalisations produced by professionals would be less informative than those produced by non-professionals, due to their more 'automatised' processing style. We shall have more to say about this issue below. For the moment, let us turn to an overview of TAP studies. We shall start by considering the major early concern of researchers working within this paradigm, namely the analysis of 'translation strategies'.² We shall then move on to consider more recent foci of attention, such as attention units, automaticity of processing and affective factors.

² The choice to classify studies according to their main object of analysis constitutes an attempt to provide as systematic a survey as possible of a body of research which is unfortunately still rather anecdotal in nature.

Strategies

The concept of strategy being highly controversial in linguistics, we shall only mention here in passing that the researchers whose work is surveyed below have either avoided a terminological discussion and used the term in a rather undefined, everyday sense, or endorsed the definition provided by Löscher (who, in turn, adapts a definition provided by Færch and Kasper, 1983), according to which a translation strategy is ‘...a potentially conscious procedure for the solution of a problem which an individual is faced with when translating a text segment from one language into another.’ (Löscher, 1991: 76)

Löscher himself (1986 and 1991) reported on a comparatively large TAP study, in which 48 German learners of English as a foreign language produced 52 translations either into English or into German. They were asked to produce a spoken translation of a written text while thinking aloud and were not allowed to use dictionaries (this was meant to ensure a larger number of problem-solving processes would be present in the protocols).³ The transcripts of the sessions were then analysed and a number of ‘translation strategies’ were recognised.

According to Löscher each strategy is formed of a sequence of core elements which can be combined in different ways. A translation process, in turn, is formed of a series of strategies, which can also be combined in different ways. The general conclusions drawn from this study are that:

TAPs seem to provide reliable and useful data, provided that the analyst interprets them in a systematic and ‘methodologically controlled’ way;

Despite individual differences and the inherent variability of the translation process, there are regularities that point at the possibility of establishing taxonomies of translation strategies; No evidence is found of translation-specific strategies: instead, general text-processing strategies are adapted to the specific task at hand.

In the experiment reported in Krings (1986), eight German learners of French as a foreign language translated a text either into or out of the mother tongue. The main focus of attention here is the identification of translation problems and translation strategies on the basis of TAPs. With regards to the former, Krings offers the following list of ‘problem indicators’:

The subjects’ explicit statement of problems;

The use of reference books;

The underlining of source-language text passages;

The semantic analysis of source-language text items;

Hesitation phenomena in the search for potential equivalents;

Competing potential equivalents;

The monitoring of potential equivalents;

³ The environmental validity of this decision seems dubious, the extra processes triggered by the absence of reference tools being an obvious result of the experimental condition, of arguably little descriptive value. Moreover, an important set of strategies (those involving the use of reference literature) remain unaccounted for.

Specific translation principles;

The modification of written target-language texts;

The assessment of the quality of the chosen translation;

Paralinguistic or non-linguistic features (Krings, 1986: 267)

With regards to translation strategies, which subjects resort to when automatic processing breaks down, Krings suggests that these can be classified as strategies of *comprehension* (inferencing and use of reference works), *equivalent retrieval* (especially interlingual and intralingual associations), *equivalent monitoring* (such as comparing Source Text (ST) and Target Text (TT)), *decision-making* (choosing between two equivalent solutions) and *reduction* (for instance of marked or metaphorical text portions).

A more complex classification of strategies is proposed by Gerloff (1986: 252ff) who, in her methodologically-oriented paper on TAP studies, describes ‘text-processing strategies’ as ‘...any metalinguistic or metacognitive comments made or specific problem-solving behaviors affected, during the decoding and rendering of the translation text’.⁴ The categories she identifies are *problem identification*, *linguistic analysis*, *storage and retrieval*, *general search and selection*, *text inferencing and reasoning*, *text contextualisation*, and *task monitoring*.

In their discussion of the use of lexical search strategies, Mondhal and Jensen (1996) distinguish *production* from *evaluation* strategies. The former are further subdivided into *achievement* strategies and *reduction* strategies (also discussed by Chesterman, 1998). Among achievement strategies, which are characterised by an attempt to remain as close as possible to the ST, are *spontaneous association* and *reformulation*. Among reduction strategies, which are characterised by their inherently remedial nature, are avoidance and unmarked rendering of marked items. Finally, evaluation strategies involve, for instance, reflecting on the adequacy and acceptability of translation equivalents.

Séguinot (1996) reports on another non-comparative study involving, this time, two professional translators working together at the same task. The underlying assumption in this case is that this everyday setting (the subjects are used to working as a team) would increase the environmental validity of the experiment, without limiting the experimental validity of the results obtained. As a result of this study four types of translation strategies are identified as being typical of ‘professional’ translation, namely *interpersonal* strategies (brainstorming, correction, phatic function), *search* strategies (dictionaries, world knowledge, words) *inferencing* strategies (rereading ST and TT, consult) and *monitoring* strategies (reread ST and TT, consult, compare units). This translating process is further described as ‘iterative’, proceeding in a non-linear fashion and operating on the basis of sentence-level ‘translation units’, which are, however, often interrupted by pauses and hesitations.

None of the studies described so far attempt to systematically compare strategies across two groups of subjects. However, finding out what it is that distinguishes professional from non-professional (student or lay-person) behaviour has always been a major concern of researchers in process-oriented translation studies. One way of investigating this issue has been to compare the performance of two groups on the same task.

An investigation along these lines is described by Löscher (1996) who, building on his previous studies (above), compares the strategies adopted by professional and non-

⁴ It should be pointed out that Gerloff is adopting, somewhat misleadingly, a very broad notion of ‘strategy’ in which problem indicators (cf. Krings, above), cognitive factors and affective factors are conflated. So, for instance, laughing and addressing the experimenter are listed under the header ‘text-processing strategies’.

professional translators (foreign language students).⁵ He points out that, although the two groups do not differ qualitatively in their use of translation strategies, they do differ quantitatively, i. e. in the distribution and frequency of the strategies employed. Furthermore, differences can be detected in the orientation of the approach (towards form in the case of non-professionals, towards sense in the case of professionals), in the size of translation units (we shall have more to say about this below), in the amount of monitoring of the TT and lastly in the attention devoted to stylistic and typological adequacy (greater for professionals in all cases).

In the study reported in Séguinot (1991), two similar texts were translated by students of translation at different levels of proficiency (at the beginning and at the end of their courses in specialised translation). French and English mother tongue speakers translated two advertisements from French into English. The main research focus was once again on the – rather loosely defined – notion of strategies. The author suggests that native speakers of English (as well as better students, the two categories are unfortunately not distinguished clearly) translating into their mother tongue show more efficient monitoring and revising strategies, and work more at the textual level, whereas non-native speakers seem to rely more on learned principles and lexical-level processes.

Building on Lörcher's definition, Jääskeläinen (1993) proposes a classification of translation strategies distinguishing between global and local strategies, the former applying to the whole task (considerations about style, readership etc.), the latter to specific items (i. e. lexical searches). On the basis of this distinction, she is able to claim that global strategies are much more frequently used by professionals and semi-professionals (translator trainees) than by non-professionals in her study. After making a plan, the former appear to follow it systematically through the task, whereas the latter seem to proceed in a more haphazard way.

Let me try and chart very briefly the ground we have covered so far. A number of TAP studies, especially early ones, have been concerned with the recognition and classification of translation strategies and with the detection of differences between professional and non-professional strategies. A number of classificatory schemes have been provided, adopting labels like *global/local*, *reduction/achievement*, *monitoring (and revising)*, *search*, *comprehension*, *equivalent retrieval*, *decision making* and so on. Besides, it has been suggested that the performance of professionals differs from that of non professionals with regards to both the quantity and the quality (orientation) of the strategies adopted. Let us now turn to consider three other issues which have been investigated by means of TAPs, namely *translation (or attention) units*, *automaticity* and *affective factors*.

Translation units

Translation (or attention) units are defined as ‘...those instances in the translation process in which the translator's “unmarked processing” is interrupted by shifting the focus of attention onto particular task relevant aspects’ (Jääskeläinen, 1990: 173, cited in Jääskeläinen 1993: 102). ‘Unmarked processing’ here refers to unproblematic sections of the protocols in which a subject verbalises fluently while reading or writing. Marked processing, then, begins with a problem indicator and ends with a solution to the problem or an indication that the problem is temporarily abandoned. A ‘unit of analysis’ coding is described by Gerloff (1986), who identifies seven levels of analysis, going from morpheme or syllabic unit to discourse. According to most researchers, the length of translation units is an indication of proficiency, with professional translators working with larger units (sentence and discourse, or group) and moving more comfortably between different unit levels. Clearly, this does not mean that a professional translator never stops midway through a sentence, but only that the sentence is processed as a unit, with more local problems tackled on the way (Séguinot 1996). The

⁵ Unfortunately, no detail is given of the design of this experiment in the paper cited.

suggestion can be put forward, therefore, that attention units are better defined in hierarchical rather than sequential terms, with smaller units being processed within larger units. The search for a term or collocation may be embedded in the processing of a whole sentence, without implying a 'word unit' or 'phrase unit' analysis.

Automaticity

Insofar as automaticity of processing is believed to result from experience and proficiency in a task (Ericsson and Simon, 1993 (1984), Toury, 1988), it is not surprising that researchers have tried to determine whether the performance of professionals is recognisably more automatic than that of non-professionals. In order to do so, they have analysed the amount of marked processing in professionals' and non-professionals' TAPs. The most straightforward hypothesis (that professionals verbalise less than non-professionals) is not endorsed by Jääskeläinen and Tirkkonen-Condit (1991) and by Jääskeläinen (1996 and 1997), who make a distinction between routine and non-routine situations. In the former, professionals do tend to verbalise less than non-professionals, whereas in the latter the amount of verbalisation is not necessarily smaller. Besides, the nature of the verbalisations tends to differ as well. The explanation offered is that '...while some processes become automated, other processes are evoked into consciousness, i. e. the translator becomes sensitised to new kinds of problems.' (Jääskeläinen and Tirkkonen-Condit, 1991: 105)

This conclusion is supported by the finding that semi-professionals (translator trainees) show more extensive processing than both professionals and non-professionals (Jääskeläinen: 1997). This may be because they are aware of the problems involved but have not yet automatised the necessary problem-solving strategies. Equally, professionals are assumed to be better at recognising the need to resort to non-automatic, controlled processes (i. e. problem recognition) than non-professionals. Automatic processes, as we saw above, are typically very efficient but little flexible so that there is the danger (pointed out by Wills, 1994: 144) 'of problems being forced into a certain structure, because it is believed to offer a solution'. A typical example of this danger would be, for instance, the difficulty experienced by non-professionals in overruling automatic lexical associations (Ivanova, 1998: 102), or 'false-friends', a process requiring high control.

Affective factors

Leaving aside cognitive issues for a moment, we shall now turn to the analysis of affective factors in translation. These have been investigated, among others, by Kussmaul (1991), Tirkkonen-Condit (1997), Laukkanen (1996), Tirkkonen-Condit and Laukkanen (1996) and Jääskeläinen (1997). These researchers agree that affective factors such as involvement with the translation task, a relaxed atmosphere and self-confidence correlate positively with successful performance. In routine tasks, where these three elements are likely to be present, subjects are found to produce better translations than in non-routine situations, where they tend to stick more to the ST and avoid reduction strategies as much as possible (Laukkanen, 1996: 266). This finding should be carefully evaluated in relation to the validity of the results obtained in experimental conditions, where affective factors are likely to influence the results obtained in unpredictable ways.

A further way into the translation process is offered by the evaluations (of self, task, ST, TT) verbalised by the subjects. According to Tirkkonen-Condit (1997: 83), there is a quantitative as well as qualitative difference between professionals and non-professionals in these regards, due to the fact that 'consciousness of the motivations and rationale of one's own performance seems to grow with translational experience'.

Conclusion

As can be gleaned from the above discussion, the large amounts of data about the cognitive and affective factors involved in the translation process which could be collected by means of TAPs have no doubt favoured a more empirical approach to the study of translation, and highlighted the limits of purely speculative models. However, the value of the classifications and observations made so far appears to be still limited. The most obvious limitation of this body of research is the fact that researchers have tended to proceed in a rather anecdotal and unsystematic way in their studies and reports, generally not providing a theoretical justification for the classification schemes they construct and very little information about their methods and findings. The next section focuses on some methodological limits of the studies discussed above, and point at possible ways of overcoming them.

Limits

As just mentioned, a major problem with TAP studies has been the lack of an established research paradigm, resulting in a rather loose treatment of methodological issues (research design, data analysis, research report) and in a host of studies setting their own categorisations in a theoretical void. Most of the research reports we have been concerned with so far describe the research design summarily, present findings in an anecdotal fashion, do not provide any statistical analysis of their data (and sometimes not even the data themselves) and leave central theoretical assumptions unexplained. The reader thus finds it difficult to assess the validity of the results obtained. Besides, the studies themselves sometimes seem to be loosely set up.

As an example, consider the discussion of 'routine vs. non-routine task', which is a central issue in Laukkanen (1996: 257). Here a routine situation is defined as 'the kind of task that is familiar to the subject from his/her daily work', whereas a non-routine situation is defined as 'practically any assignment that the subject is not very familiar with'. This definition seems to be inherently ambiguous, as no explanation is given of what familiarity and non-familiarity imply. Are we dealing with content or form? Are we going to label as 'routine' a text that deals with a familiar subject, but belongs to a text type the subject has never translated before or rather a familiar-text type with unfamiliar subject matter? Another aspect to consider is the difficulty of assessing the comparability of texts belonging to different text types. The hypothesis that translators behave in different ways in routine and non-routine situations can only be tested by trying to control all variables apart from familiarity. This is a dismal endeavour, since the two texts might differ along an almost infinite number of dimensions, the most obviously relevant being difficulty. Though no claim is made that these extremely challenging problems could have been solved easily, this study would certainly have gained from a more careful treatment of terminological and theoretical issues.

Another problem with most of the studies dealt with here is the excessive reliance on between-subject designs, used to compare the performance of professionals with that of semi-professionals and/or non-professionals. This is a very controversial design, which is nonetheless normally posited without further discussion. Even if we had an uncontroversial way of determining what professionalism involves — and we do not, resorting to external measures such as years of experience and official certifications only partially solves the problem — we would still have to take into account individual differences in the ability or disposition to verbalise, interests, involvement with the task, variable effects of the experimental condition and so on. This preoccupation is shared, for instance, by Krings (1987: 167) who claims that 'individual differences between subjects with regard to their willingness to verbalise might be greater than Ericsson & Simon seem to assume'.

Lastly, it is necessary to mention a general methodological problem with TAP studies in translation research. As a method of data collection in cognitive science, TAPs are recognised as valid only inasmuch as they have been collected under very rigorous experimental conditions. When TAPs are used in translation research, these conditions are very often relaxed. Although this is partly due to the justified need to preserve environmental validity, this tendency should be checked, as it may result in the invalidation of the results obtained. Two examples will illustrate the point.

1. According to Ericsson and Simon's (1993 (1984)) theoretical framework, social interaction during the verbalisation should be avoided at all costs, as the need to communicate in a structured way is likely to interfere with the task being carried out in unpredictable and uncontrollable ways. However, a number of studies have investigated *dialogue* TAPs (Séguinot 1996, Kussmaul 1991) — a contradiction in terms — and claimed for them the same empirical validity as for *monologue* TAPs.

2. It has been claimed (Færch and Kasper (1987: 15) that '...simultaneous introspection... in terms of concurrent talking or thinking aloud or verbalization of specific cognitions, presupposes that the modality of language use is not itself oral-productive.' This is because two concurrent tasks of the same kind may interfere with each other in ways still unpredictable at the present stage of research. However, the influential study conducted by Löscher (1991) required subjects to think aloud while carrying out a written-to-spoken translation task.⁶

Summarising the points made in this sub-section, there is a lot of work to do in process-oriented translation studies in order to raise the standard of research in this area to the levels required by empirical linguistics research. A crucial problem to tackle at present is the establishment of a more rigorous experimental methodology, which takes into account issues of experimental and theoretical as well as environmental validity, both in the collection and in the analysis of data. The following section describes the preliminary stages of a pilot experiment which attempts to heed these suggestions.

TAPs: a pilot study

The study which makes the subject of this section is still in its infancy: analysis of the data collected has only just begun, and no conclusive results can as yet be presented. The concerns of this paper being primarily methodological, we shall be dealing here mainly with the design and set-up of the experiment, and merely *suggest* potential ways of analysing the data obtained that might yield valuable insights into the process of translation. After describing the purposes of the study and the questions it addresses, we shall go on to discuss the methodology adopted, and finally point at some provisional suggestions about data analysis and expected results. As a way of concluding this paper, we shall finally assess the qualities and limits of this study, and make suggestions for further research.

⁶ This procedure also begs the question of the relationship between the processes involved in oral vs. written translation. In this study it is assumed that the difference between the two is not relevant (but cf., on this point, Toury, 1991).

Introduction

As discussed in the previous section, a number of studies have been concerned with the effects of routine/non-routine task conditions. One of the conclusions drawn from these studies has been that routine conditions seem to result in higher levels of automatic processing by professional translators, whereas non-routine conditions may prompt a less automatic (and in general less ‘professional’) behaviour. The notion of ‘routine vs. non-routine condition’, however, is highly controversial. So far, researchers have been contented with positing routine-ness on the basis of external factors such as experience and similarity among text-types. As already pointed out, this procedure does not seem satisfactory. A difference between ‘routine’ and ‘non-routine’ conditions can only unambiguously be determined by relying on internal factors (i. e. *if* a translator behaves in different ways in the two conditions, *then* we can suggest that there is a difference). We are faced here with a problem of circularity: we need to know what routine conditions are in order to investigate how translators behave in such conditions, but the only satisfactory way of determining what is routine is to rely on the behaviour of translators.

One of the aims of this study is to try and find out whether there is a way of bypassing this apparent dead-end. A potential routine vs. non-routine situation is created: professional translators are asked to translate two texts, one into their mother tongue (their daily working condition) and one out of it (a very unusual condition for all these subjects). Insofar as all the subjects are also teachers of translation,⁷ their knowledge of the L2 is supposed to be good enough to allow them to carry out a non-technical translation task. Besides, the quality of the final product is treated as a secondary feature here: the main focus is not on the relative quality of the translation into vs. out of the mother tongue, but rather on the (different?) processes observed in the two tasks carried out by the same subject. Nonetheless, it was made clear to the subjects that they should aim at professional quality, so as to approximate a real situation as closely as possible.

A further aim of this study is to investigate the professional vs. non-professional distinction using a *within-subject* design. The usual way of carrying out investigations of this sort has been to adopt a *between-subject* design, comparing the TAPs produced by professional translators with those produced by students of translation and/or laypersons. However, in experiments which do not normally involve more than ten subjects (and at times as few as two) and in which individual differences may play a very considerable role, the adoption of between-subject designs would appear to require careful consideration (cf. on this point Krings, 1994 (above)).

The decision to adopt a within-subject design, therefore, stems from considerations about the idiosyncratic nature of the translation process, which cannot be reduced to a series of predictable and formalisable problem-solving steps (as in most of the studies reported by Ericsson and Simon, 1993 (1984)), and which is heavily influenced by individual cognitive and affective differences. In order to neutralise the effect of these differences, the performance of the same subject is investigated across different task conditions, on the assumption, discussed in 2.2.2 above, that more signs of professionalism will show in the familiar than in the unfamiliar condition. The learning effect that might result from carrying

7. The original design of the experiment involved *only* professional translators who are also translation teachers. However, while administering the tests, one of the subjects refused to carry out the non-routine task, and was consequently excluded from the study. The only other subject available at that point was a professional translator with a degree in translation but somewhat less experience of professional translation and no experience of translator training. Given the design adopted (within-subject), this accident, though unfortunate, does not appear to have invalidated the experiment itself.

out the two translation tasks in a sequence is judged to be negligible if compared with the advantages obtained.

A third and subordinate aim of this pilot study is to try and shed light on the interrelations between professionalism, routineness and translation into or out of the mother tongue. It has been claimed (by Séguinot, 1991, Krings, 1987 and more recently by Campbell, 1998) that the processes involved in the latter two tasks may be different. To give just one example, translators working out of the mother tongue would appear to employ fewer output monitoring strategies — a point made, by both Campbell (1998) and Séguinot (1991) — than translators working into it. Insofar as the same suggestion is put forward by Löscher (1996) with regards to professional vs. non-professional behaviour, the hypothesis that varying the task conditions as was done in this experiment may simulate both a professional/non-professional distinction, and a ‘direction of translation’ distinction, seems to gain support. Further study is needed to investigate more closely the interrelations between the two variables, which are here merely hypothesised to be related.

Method

Four professional translators and teachers of translation at the School of Modern Languages for Interpreters and Translators of the University of Bologna (Italy) were required to translate two brief texts, one from English into Italian and the other one from Italian into English while verbalising their thoughts.

The subjects were selected on the basis of a questionnaire administered one or two days before the experimental sessions were to take place. Two of the subjects were to be mother tongue speakers of English (preferably of the same geographical variety of the language), and two were to be mother tongue speakers of Italian. This design was meant to ensure that differences observed in the translation processes of individual subjects translating into or out of their mother tongue would not be due to idiosyncrasies, relative difficulty of the two texts, or biases due to specific characteristics of the Source/Target language. In other words, the only reason for carrying out between-subject comparisons in this study is that of providing support for within-subject observations.

The questionnaire was meant to provide the experimenter with information on which to base the selection of the subjects. The questions ranged from personal information (age, country of origin, place, level, and type of education) to professional background (experience with interpreting,⁸ familiarity with translation out of the mother tongue, years of experience as a translator and translation teacher, areas of interest or specialisation, reference works used for non-technical assignments). The subjects who accepted to participate in the study were matched by age/experience (one Italian/English pair being in the 30-40 age band, the other in the 40-50 age band), but not by sex (both the Italian translators are female, both the English are male). As already pointed out, a perfect matching was not required by the experimental design.

The experimental sessions took place in the author's office, at the time most convenient for the subjects. Because of the requirement to verbalise, which is likely to variably affect the performance, no time limit was set for the task. The use of dictionaries, as well as of any electronic tools (the Internet or corpora available at the School) was allowed, the only limitation involved being availability. However, the subjects were asked to simulate an everyday situation, using only those tools they were familiar with (the risk of dictionary overuse due to ease of access is pointed out by Jääskeläinen, 1997). Copies of the magazines where the texts to be translated had been taken from were also available for consultation.

⁸ It was hypothesised that experience with simultaneous interpreting might have an effect on the ability to verbalise thoughts.

The texts to be translated (in appendix) were short news articles taken from *New Scientist* and *Newton* (an Italian magazine comparable to *New Scientist*). The texts are quite short (slightly longer than 100 words), unabridged, and deal with popular science topics (the discovery of two planets outside the Solar System and of a carbon molecule). The translation briefings required the subjects to translate the text taken from *Newton* for publication in *New Scientist* and viceversa. Titles were also to be translated.

At the beginning of each experimental session the subject was given a written explanation of the aim of the study, of the development of the experiment, and of what s/he was expected to do. This was also read aloud by the experimenter, who then asked whether there were any questions. If not, the subject was given a short warm-up task in order to familiarise her/him with thinking aloud. This task was designed so as to have as little a learning effect as possible on the first experimental task: two entries from the content pages of *Newton* and two from those of *New Scientist* (in appendix) were presented to the subject for translation. These entries were chosen because they are very brief (30 words on average) and do not require any contextualisation.

The administration of the translation tasks was balanced in the following way:

Subject		First task	Second task
Italian translator	1	English → Italian	Italian → English
Italian translator	2	Italian → English	English → Italian
English translator	1	English → Italian	Italian → English
English translator	2	Italian → English	English → Italian

Table 1. Administration of the translation tasks

Both the warm-up and the two experimental tasks were tape-recorded.⁹ Besides, since the subjects were translating using a word processor, a software program was used which records every mouse movement and keyboard strike. It is thus possible to replay the whole task, observing, for instance, corrections, hesitations, movements backwards and forwards through the text, and so on.

The experimenter never left the room during the sessions. However, her intervention was limited to turning the tapes, giving reminders to verbalise if subjects stopped talking for longer than one minute, and answering the rare questions that the subjects asked. Interaction was not encouraged in any way.

At the end of the first task the subjects were asked whether they wanted to take a short break. If not, they were given the second task. At the end, they were asked to report on what they remembered about the two experimental tasks (problems, thoughts, feelings). A retrospective report was not required. It was felt that the subjects were already tired from carrying out the think-aloud tasks. Besides, a formal follow-up session would only make sense after the TAPs had been transcribed, and at that point the subjects were no longer available.

Lastly, the subjects were asked to fill up another short questionnaire, saying whether they felt that the experimental condition had interfered with their thought processes, how they felt about the two texts/tasks and so on. This mixture of structured and unstructured report

⁹ Video-recording was thought to be too invasive and not particularly informative.

seemed to provide a good balance between the need to elicit certain information and the preoccupation not to spoon-feed the subjects with answers.

The translations were then sent out to four professional translators and teachers of translation (two native speakers of English and two native speakers of Italian) for scoring and ranking. Each scorer was also asked to provide general comments about the quality of the translated texts as well as a mark for each individual sentence. This information about the output of the translation process was collected as back-up evidence, but was not considered to be crucial for the kind of analysis envisaged.

The recordings were transcribed verbatim, with coding reduced to a minimum. At this stage of the study, only pauses longer than two seconds, broad intonation profiles (like 'rising' for questions), paralinguistic features (such as laughing and sighing), unclear verbalisation, fast reading and emphasis were coded. Coding was inserted in the text within angled brackets. In this way, an HTML-like text was produced. Even though most of the coding does not conform to the HTML syntax, this coding system allows the user to look at the text with codes showing (using a word processing program) or concealed (using a web browser). Samples of a TAP in both HTML and Word for Windows formats are enclosed in appendix, together with a list of the symbols used in the transcription. In the future these transcriptions could easily be made to conform to the TEI guidelines for text-encoding and interchange¹⁰ and form the core of a think-aloud corpus for the computational analysis of translation processes.

Results

As already suggested above, no final results from the study just described are at present available for discussion. However, an example can be provided of the kind of analysis that will be applied to the data collected, and suggest ways in which such an analysis can be further deepened and expanded.

Pauses

The data regarding pauses summarised in the table below refer to a single subject's TAP. The subject is British, male, aged between thirty and forty. All the pauses longer than two seconds have been classified according to their nature, and the number of pauses, mean length and standard deviation from the mean for each set have been calculated. A look at the table can give us a preliminary idea of the main differences between the two sets of observations (those relating to translation into the L1 vs. those relating to translation into the L2).

This translator seems to pause to think much more frequently while translating out of his mother tongue. In this condition he also consults dictionaries more often. More precisely, he uses *bilingual* dictionaries much more often, whereas his use of monolingual dictionaries does not increase in any noticeable way. In the opposite condition (translation into the L1), on the other hand, he appears to spend longer consulting magazines. The latter finding cannot be explained by reference to a learning effect (once familiar with the magazines style, he would not need to consult them anymore¹¹) since translation into the L1 was the second experimental task in his case.

It would be tempting to interpret these findings as indicating a more automatised translation process as well as a greater concern with stylistic issues (comparable text search) in routine (translation into L1) than in non-routine conditions. Such findings would nicely support the claims made in the literature discussed above. However, none of these

¹⁰ Further information about TEI is available from: <http://www.uic.edu/orgs/tei/>.

¹¹ I am grateful to Henriette Hendricks for pointing out this possibility to me.

conclusions are warranted by the data presented here. In order to be able to make similar claims, we not only need to assess the significance of the difference between the two sets of data statistically; we also need to compare the results of the analysis of this TAP with those for the other TAPs collected - a procedure that requires a very substantial amount of work to yield valid results. In the absence of such a comparison, we are not able to claim that the effect observed is indeed significantly related to our independent variable (direction of the translation process). Rather, it might be caused by a difference in complexity between the two tasks, or in the inherent difficulty of translating into Italian rather than into English, and so on. These possibilities cannot be ruled out at the present stage of the analysis. Accordingly, we shall not deal with the data any further, and turn instead to a discussion of how the analysis would be conducted if this study were to proceed.

Description		Ita into Eng (L2→ L1)	Eng into Ita (L1→ L2)
Think and think/type	Number	69	132
	Total Duration (secs)	403.32	816.96
	Average Duration (secs)	5.845	6.189
	Standard deviation (N-1)	4.080	3.986
Reference look-ups			
Dictionary (unspecified)	Number		8
	Total Duration (secs)		67.47
	Average Duration (secs)		8.43
	Standard deviation (N-1)		6.34
Collins Cobuild	Number	4	3
	Total Duration (secs)	13.6	12.25
	Average Duration (secs)	3.4	4.08
	Standard deviation (N-1)	1.54	1.72
Shorter Oxford English Dictionary	Number		1
	Duration (secs)		12.35
Zingarelli (Italian monolingual dict.)	Number	1	
	Duration (secs)		5.65
Sansoni Ita-Eng/Eng-Ita (bil. Dict. 2 vols)	Number	1	13

	Total Duration (secs)	9.40	75.96
	Average Duration (secs)		5.84
	Standard deviation (N-1)		2.77
Magazines		<i>New Scientist</i>	<i>Newton</i>
	Number	4	1
	Total Duration (secs)	38,57	5.64
	Average Duration (secs)	9.642	
	Standard deviation (N-1)	4,297	
Fast reading	Number	18	23
	Total Duration (secs)	41.07	64.73
	Average Duration (secs)	2.281	2.814
	Standard deviation (N-1)	1.983	2.161
Unclear	Number	5	1
	Total Duration (secs)	11.6	0.45
	Average Duration (secs)	2.32	
	Standard deviation (N-1)	2.053	
Other	Number	1	
	Duration (secs)	4.98	

Table 2. Number, duration, and type of pauses in a sample transcript.

Future prospects

The procedure of data collection and analysis presented here can be applied not only to pauses and reference look-ups, but to a large number of other observations as well. Most of the parameters mentioned in the literature could easily be accommodated in tables such as the one reproduced above. We could thus compile tables comparing, for instance:

<p>Strategies (Krings, 1986; Gerloff, 1986)</p>	<p>Comprehension (inferencing and dictionary use) Equivalent retrieval (collocation, association) Equivalent monitoring (choosing equivalents) Reduction (simplification, unmarking, avoidance) Linguistic analysis (syntactic grammatical, lexical) Inferencing and reasoning (world knowledge and personal experience) Contextualisation (restates information, uses context) Editing (correction, congruity assessment, punctuation, changes to TT)</p>
<p>Evaluations (Laukkanen, 1996)</p>	<p>Of ST Of equivalents General evaluation/comments Of translation performance Of reference material</p>
<p>Involvement markers (Östman, 1986, cited in Jääskeläinen, 1997)</p>	<p>1st person references References to mental processes (<i>I think</i>) Vagueness (hedges, empty pronouns) Monitoring information flow (<i>anyway, right, then</i>) Emphatic particles (<i>really</i>) Precision (examples, analogies) Evaluation of ST, TT, reference material, self</p>
<p>Length of units of analysis (Gerloff, 1987)</p>	<p>Morpheme or syllable Word Phrase Clause Sentence Discourse Group</p>
<p>Translation maxims (Mondahl & Jensen, 1996; Königs and Kaufmann, 1996)</p>	<p>Does the informant read the ST? Does s/he notes down potential problems (mentally or on paper)? Is evidence of macrocontextualisation present (text awareness)? Is audience considered? Is verbatim translation the goal? Is the procedure linear or circular? Is the briefing influential?</p>

Table 3. Summary of the parameters discussed in the literature.

We could then measure the significance of the difference and compare these values with those found in the other three TAPs. In this way we would obtain an exhaustive characterisation of the translation processes involved in translating into and out of the mother tongue.

An even more ambitious suggestion for further research would be to try and carry out a factorial analysis of the values thus obtained, along the lines described by Biber (1988) in relation to text-type classification. In this way it might be possible to find correlations among parameters, which could then be grouped together and interpreted functionally. We would thus be able to develop an internal measure of routineness and, potentially, gain insights into the nature of 'translation into L2' competence (Campbell, 1998). Such an endeavour, however, is well beyond the scope of this paper, whose main concerns were primarily methodological, and can only be undertaken within the framework of a considerably larger study.

Conclusion

The aim of this paper has been to discuss some methodological issues relating to the use of think-aloud protocols in process-oriented translation studies. This research methodology has been shown to provide a very promising framework for the investigation of the cognitive aspects of translation, a field of study that could hitherto only be tackled speculatively. In the last few years substantial effort has been put in this area of research, resulting in a large amount of very valuable insights about the cognitive and affective factors involved in translation. At this early stage of research, the data have been mainly used in a rather informal way, as a source of suggestions and examples about the behaviour of translators: their strategies, affective involvement, units of analysis, evaluations, translation maxims and so on. The ultimate goal of this work has obviously been to shed light on the characteristics of successful translation processes in terms of their underlying constituents. For this reason, the main focus of attention of researchers has been the comparison between producers of 'good' and 'bad' translation, on the assumption that the quality of the products might correlate with some features of the processes.

There is nothing inherently wrong with this approach. However, now that experience with empirical translation studies has started to pile up, and a substantial number of 'informal' hypotheses have been made, it would seem to be time for researchers in the field to start questioning the methodological assumptions of their work more systematically. It is time, in other words, to check the validity of these informal hypotheses by means of more controlled experimental designs and methods of data analysis.

The experiment whose early stages (experimental design and data collection) are described in this paper constitutes a move in this direction, its aim being to address a number of concerns with the experimental validity of the studies discussed in its introductory sections. The main priority in this case has been to try and limit the biasing effect of individual differences through within-subject design. The research questions addressed relate to an empirical assessment of the difference between

- a) routine and non-routine translation situations;
- b) translation into and out of the mother tongue and
- c) professional and non-professional translation processes.

A very rigorous methodology of data collection has been adopted, which is discussed at length above. It is believed that an exhaustive report of the method employed is a requirement of any research report, and a fundamental prerequisite for the interpretability and reusability of the data and results provided.

Even though no results could be provided at this stage, the procedure of analysis developed for this study (a systematic statistical comparison of data relating to the cognitive

and affective factors observed in the performance of the same individual across two tasks) would seem to be very promising and relatively unproblematic. By comparing the amount and nature of a large number of process indicators for different tasks, it would be possible to limit (though not cancel) the risk of searching the protocols for examples of elements supporting one's own beliefs and preconceived ideas. This method of analysis might help researchers describe a translator's performance under varying conditions more exhaustively than hitherto possible. Among the advantages of a study thus conducted, the development of an internal measure of professionalism and routine-ness, on which to base further studies.

Apart from the obvious necessity to adopt a scientifically sounder methodology of data collection, the way ahead in process-oriented translation studies would appear to involve the development of a relatively uncontroversial classification of process indicators. Such a classification could limit the proliferation of terminological distinctions in the literature, and provide researchers with an instrument for the systematic analysis and description of TAPs. Presently, these seem to be necessary steps if the discipline is to proceed beyond the somewhat rudimentary stages with which this paper has been concerned.

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Appendix

Source Text (English → Italian)

Cute clusters

FROM diamonds to buckyballs, carbon has many personalities. Now Russian scientists say carbon atoms may form small clusters they call "prismane".

Scientists studying three-dimensional clusters of carbon thought they would be unstable if they contained fewer than 14 atoms. But now computer simulations by Leonid Openev and Vladimir Elesin at the Moscow State Engineering Physics Institute have shown that clusters of eight carbon atoms can be stable if six of the carbons are arranged at the corners of a prism-shaped molecule, with each end capped by another atom.

Although the lifetime of prismane clusters would be short, the scientists say they should be able to find some.

Source Text (Italian → English)

Lieti eventi: scoperti due nuovi pianeti fuori dal sistema solare

Due astronomi americani, Geoffry Marcy e Paul Butler, hanno scoperto a meno di 150 anni luce dalla terra due pianeti grandi come Giove, che orbitano intorno a due stelle simili al sole. L'annuncio è stato fatto all'Università della California a San Francisco. Con questa scoperta, il numero dei pianeti "extrasolari" scoperti dal 1995 a oggi sale a dodici. Gli scienziati ne hanno dedotto l'esistenza puntando, uno dopo l'altro, i due telescopi Keck installati a Mauna Kea (Hawaii) e osservando piccolissime perturbazioni sulle stelle vicine, causate appunto dalla presenza dei pianeti.

Transcription codes

Pause: <pause=value; secs=>

values: dict (unspecified dictionary)

CC (Collins Cobuild)

S I E (Sansoni Italian - English; bilingual dictionary)

S E I (Sansoni English - Italian; bilingual dictionary)

Z (Zingarelli; monolingual Italian dictionary)

SOED (Shorter Oxford English Dictionary)

mag (unspecified magazine)

NS (New Scientist)

N (Newton)

Emphasis: (bold appearance)

Intonation: <int=value></int>

values: rise (questions)

interrupt (unfinished utterances)

Paralinguistic features: <para=value></para>

values: laugh

sigh

cough

weep-like

Slow talking: <slow> </slow>

fast talking: <fast> </fast>

Fast reading (unclear): <read= secs>

Unclear verbalisation: <unclear=secs>

Reading (ST, TT, Other): <i> </i> (appearance: italics)

Sample TAP (HTML)

ok now let's see *lieti eventi* maybe great news but probably I'm putting great news because I want to start writing something ehm and this means that I could well go back to it ehm now again I could put two new planets discovered outside the Solar System rather boring though is it? not not particularly attractive as a title maybe I'll change news to discoveries no I think I'll put two new planets discovered so I'll go back to great news and then two new planets discovered outside the Solar System have to spell it properly System ok *great news two new planets discovered outside the Solar System* ok and from there I haven't got it in bold but let's

imagine I have I think I will stick to the typology of the original ok *due astronomi americani*
 ok ok now do I want to use a fairly short sentence to open the text something like two
 American astronomers have made a an important discovery yes perhaps I will perhaps I'll just
 introduce it with a fairly short sentence so two two American astronomers I'm gonna put a the
 comma and put the names as in the Italian G.M. and P. B.

Sample TAP (plain text)

ok now let's see <i>lieti eventi</i> maybe great news but probably I'm putting great news
 because I want to start writing something ehm and this means that I could well go back to it
 <pause=think; 8.30> ehm now again I could put two new planets discovered outside
 <int=rising>the Solar System</int> rather boring though <int=rising>is it?</int> not not
 particularly attractive as a title <pause=think; 24.50> maybe I'll change news to discoveries
 <pause=type; 4.54> <pause=think; 4.24> no I think I'll put two new planets discovered so I'll
 go back to great news and then two new planets discovered outside the Solar System have to
 spell it properly System ok <i>great news two new planets discovered outside the Solar
 System</i> <pause=think; 3.05> ok and from there I haven't got it in bold but let's imagine I
 have I think I will stick to the typology of the original ok <i>due astronomi americani</i>
 <read=8.25> ok <pause=think; 11.78> ok now <int=rising> do I want to use a fairly short
 sentence to open the text</int> something like <int=rising>two American astronomers have
 made a an important discovery </int> <pause=think; 9.20> yes perhaps I will perhaps I'll just
 introduce it with a fairly short sentence so two <pause=type; 6.63> two American
 astronomers I'm gonna put a the comma and put the names as in the Italian G.M. and P. B.

