Patterns of shallow text production in translation

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Abstract. The depth and timing of source text understanding during translation production is controversial in translation process research. Two theories seem to compete: defenders of the *deep/alternating* school assume that translators proceed in cycles of comprehension-transfer-production, while other translation scholars suggest that translations may be produced in a fashion of *shallow* and *parallel* comprehension and production. We assess these hypotheses by comparing text production activities in a copying task and in a translation task. Text copying constitutes a kind of baseline for text production in general as we can assume that any other form of text production (including translation) requires more time and effort than merely text reproduction. Surprisingly, however, we observe similar patterns of keystroke behaviour in copying and translation.

1 Introduction

Translation scholars disagree to what extent translation requires a *deep* or *shallow* understanding of the source text (ST), and to what extent translation is a stratificational or a parallel ST comprehension → TT production process. Craciunescu et al. (2004), for instance, claim that "the first stage in human translation is complete comprehension of the source language text". Only after this complete (i.e. *deep*) comprehension is achieved can the translation be produced. Similarly Gile (2005), suggests a stratificational translation process model, in which a translator iteratively reads a piece of the ST and then produces its translation: First the translator would create a "Meaning Hypothesis" for a ST chunk (i.e. a Translation Unit) which is consistent with the "context and the linguistic and extra linguistic knowledge of the translator" (p. 107) for which then a translation can be produced.

Also Angelone (2010) supports that translators process in cycles of comprehension-transfer-production. Uncertainties of translators could be attributed to any of the comprehension, transfer, or production phases, and it is claimed that "non-articulated indicators, such as pauses and eye-fixations, give us no real clue as to how and where to allocate the uncertainty" [p.23]

Some scholars challenge these views, stating that translation processes are based on a *shallow* understanding of the ST and that ST understanding and TT

production can occur in *parallel*. Ruiz et al. (2008) investigate theories of translation along the lines *shallow/parallel* and *deep/alternating*.[1] They find "code-to-code links between the SL and TL at least [on] the lexical and syntactic level of processing", and assume a parallel process, where "the translator engages in partial reformulation while reading for translating the source text". They come to the conclusion that translators switch between the two modes, but more often chose the shallow/parallel one. Also for Mossop (2003), there exist "direct linkages in the mind between SL and TL lexicogrammatical material, independent of 'meaning'": The translator "automatically produces TL lexical and syntactic material based on the incoming SL forms".

We investigate these hypotheses from an empirical angle by analyzing the interaction of reading and text production activities in a text copying and a translation tasks. We take it as uncontroversial that a copyist, in contrast to a translator, may proceed in a shallow/parallel manner: (1) apart from lexical encoding and decoding, text copying does, in theory, not require any deep ST (or TT) understanding (2) reading and writing processes can occur to a maximum amount in parallel during text copying, since no cognitive effort is required for lexical transfer, for syntactic reordering, or for revision. Copying speed would thus essentially depend on the typing skills of the copyist.

The *deep/alternating* hypothesis implies that we can see a clear distinction between reading and writing activities so that the typing speed of a translator is reduced due to the need to first understand the ST passage before starting to type in its translation.

In this paper we compare the typing activities of the copying task with typing activities in translation production and observe, surprisingly, the same patterns. We show instances of typing activity in unchallenged translation which resembles text copying into another language.

Our investigation is based on a collection of activity data from two different tasks. First, an English text of 168 words had to be re-typed (copied) by 10 experienced L2 English translators. A second English text of 160 words is the basis for two translation examples which are discussed in the first part of section 3 and which represent unchallenged and smooth translation progression. This text was translated by two experienced translators. All translation examples are English texts translated into Danish by experienced translators (more than 8 years of professional experience).

We record keystroke and gaze movements during the copying and translation tasks using the Translog software. Translog is a data acquisition software (Jakobsen, 1999). It consists basically of two windows which horizontally divide the screen into two halves; the top window plots the ST, and the bottom window is an editor in which the translation is to be typed. It is possible to register keystrokes and gaze activities in Translog, which are collected and can be replayed, and visualized in progression graphs as in figures 1, 2, and 3 below.

We compare typing and gazing behaviour during the translation and text copying tasks. We first introduce a cognitive model of text copying in section

[1] Respectively horizontal/parallel vertical/serial in in their terminology.

2 and compare our empirical copying data with the predictions of that model. In section 3 we compare the copying behaviour with patterns observed during challenged and unchallenged translation, and section 4 discusses the findings and draws conclusions.

2 Text Copying

In this section we introduce a cognitive model of text typing. We will then illustrate the model with a typing example from our data. In section 3 we will compare these experimental findings with examples taken from a translation session.

2.1 A cognitive model of typing

John (1999) suggests a three step model for typing: First a perceptual operator perceives a written word. Then a cognitive operation retrieves the spelling of the word from long-term memory, and finally a motor operator finds a key on the keyboard and hits it. John makes a distinction between copying of single (sequences of) characters and more complex symbols. For the more complex symbols, like words and syllables, a cognitive operator is required to retrieve the spelling of the word from long-term memory and to initiate the typing of each character. Hence, between the perception of a word and its typing an encoding (perception) and decoding (memory retrieval) of the symbols is performed.

With the assumption that a skilled typist produces about 30 words per minute, she comes to the following figures:

1. A perceptual operator reads a word of about six letters and encodes it in 340 msec
2. Next, another cognitive operator retrieves a spelling list of the word from long-term memory, serializes it, and trigger the typing of each character. This operation has a cycle time of 50 msec.
3. Finally, the motor operator needs 230 msec to type a character on an alphanumeric keyboard at a rate of about 30 words per minute

John assumes that each of the operators works serially in themselves (only one keystroke can be processed at any one time) but that they can work in parallel with each other, with the following seriality restrictions that:

- perception has to be completed before getting the spelling list from long-term memory and before initiation of a character can begin.
- once a character is initiated with a cognitive operator, the motor operator cannot be stopped.
- the perceptual processor stays three words (i.e. chunks) ahead of the cognitive processor.

John uses this model to analyze which of the three operations (reading/retrieval/typing) are the limiting factors in text copying. She finds that the overall typing speed depends to the largest extent on the time needed for motor activity, rather than for perception or cognitive control. In line with other researchers, John assumes that the 50msec of cognitive cycle time are constant and hence the typing skills are often the limiting factors in text production.

2.2 Copying an easy text

To illustrate the analysis of a typing process, we reproduce an example from our experimental data. A text of 9 sentences and 168 words had to be copied by 10 English L2 speaker using the Translog tool. Keyboard and gaze activities were recorded during the copying process. Example 1 shows a fragment of the 3rd sentence of the text.

Example 1:

> The rise in unemployment has spattered a once-profitable business with red ink.

The sentence consists of 13 words (including sentence final dot) with 80 characters (including inter-word blank spaces). One of the copyists has copied the sentence in 21 seconds with 5 typos. Figure 1 shows the copy-progression graph: the vertical Y-axis plots the original sentence which was to be copied; the horizontal X-axis represents a time line in msec. Fixations on source text words are marked by a blue cycle. Typing activities consist of text insertions and deletions (in red).

The figure shows a time fragment of 21 seconds between msec. 58000 to ca. 81000 in which the above sentence is copied. At the beginning, the typist first gazed at the two words "The" and "rise" before starting typing. Two typos occur in the first word when reproducing "The". These typos were immediately corrected. Perrin (2003) suggests a short-hand form to represent writing activities, where correction are represented in square brackets. In this notation, the typing pattern would be represented as: "Th[i-][r-]e" which is read as follows: First the typist writes "Thi-".[2] Then "i-", the blank space (i.e. "-") and the "i" are again deleted, then "r-" is typed and again deleted, until finally the correct "e" is typed. There are thus 4 correcting keystrokes in the production of "The". The typist goes then on immediately with the typing of "rise", without looking back into the source text. There are two fixations just before msec 62000, one on "rise" and one on "unemployment" the latter one while already typing "in". From the progression graph it appears that the word "in" was actually not looked at – however, it is likely that this word was in the parafoveal scope of the fixation on "rise".

The copy activity then goes on smoothly. There are two more typos and deletions, but the typist seems to copy the text without much hesitation, looking

[2] The blank space is represented as a dash "-" in the graph and in figures below.

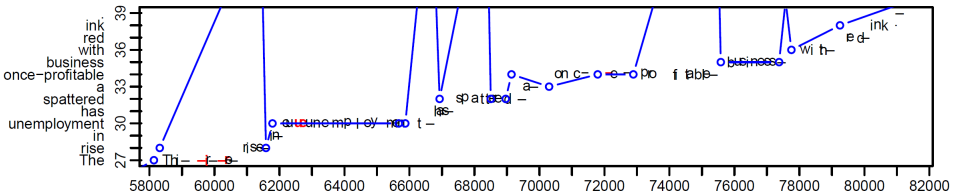

Fig. 1. A progression graph for unchallenged text copying

in general only one word ahead in the source text. In some cases the typist verifies the spelling of a word that is being typed (e.g. "spattered" around time stamp 69000) and in other instances she already scans the next word while still typing the previous word (e.g. also "spattered" around 67000 ms).

According to John's model, a skilled typist would need for keying the 80 characters 80 * 230msec plus an initial 390msec for reading the first word, 340msec for perception of the first word plus 50msec for retrieval of the spelling list. Counting each of the 7 typos as 2 keystrokes (one for insertion and one for deletion), the predicted typing time, according to John's model, amounts to approximately 22 seconds. Compared with the measured typing time of 23 seconds, the model predicts pretty well with an error rate of less than 5%. While the model, thus, seems to be quite exact for predicting the overall time needed when typing activities go smoothly, it does not seem to be so precise for predicting the gaze activities and the structure of the gaze/keystroke coordination: John's model predicts a consistent three words look-ahead. However, figure 1 shows that in many cases only one word is looked ahead from the position that is currently being copied. In addition, longer (or more difficult) words - as in the case of "unemployment" and "once-profitable" - may trigger re-fixations, and in some short words are not fixated at all, which is not predicted in Johns copying model.

3 Translation

In this section we look at translation activities. We distinguish between alternating and parallel activities. The term "alternating" is used when a translator at any one time either reads (the ST) or writes (the TT). During "parallel" activities, the translator does both, reading and writing at the same time.

3.1 Parallel reading and writing

Figure 2 shows an example of parallel translation activities. It represents a translation progression graph for the English source sentence in example 2 into Danish:

Example 2

> Police officer Chris Gregg said that Norris had been acting strangely around the hospital

Danish translation:

> P[i]olitiins[ep]pekt[rør]ør Chris Gregg sagte at Norris havde opført sig sært på h[i]o[p[si]s]sp[o]italet

Figure 2 shows a time fragment of 28 seconds (seconds 149-177) in which the translation in Example 2 is produced. The Danish translation consists of 12 words with 79 characters and 12 typos.

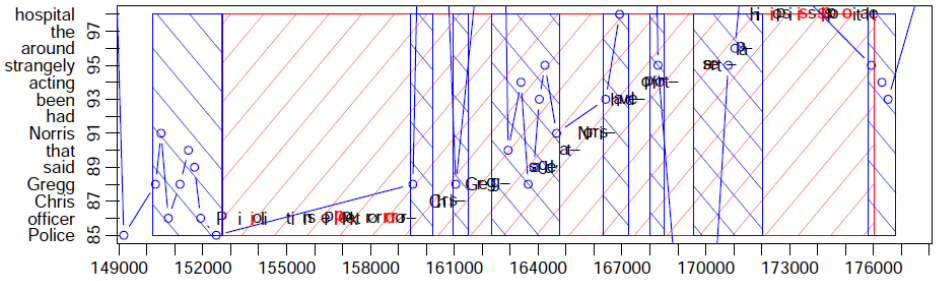

Fig. 2. The translation progression graph shows parallel reading and typing activities

As in the previous copy-progression graph (figure 1), the vertical axis in figure 2 plots the ST words while the horizontal axis represents a time interval in which the translation is produced. The (blue) dots are ST fixations and the downwards hatched boxes represent "fixation units". A fixation unit (FU) consists of a sequence of coherent fixations on the ST, where no pauses of more than 400ms occur between successive fixations. A FU, thus, represents a reading pattern of a ST chunks in which (presumably) the perception and encoding of the ST words take place. There are several FUs in the translation progression graph in figure 2, two of which represent extended reading activity. The first one occurs at the beginning of the sentence, during the time stamps 149 and 152. The translator's eyes move back and forth in the chunk "Police officer Chris Gregg said that Norris". After this the translation "Politiinspektør" is typed including a number of typos, which are immediately corrected (deleted characters are in red). The following production of the proper noun goes on smoothly.

The other extensive FU occurs between seconds 162 and 165. Here the fragment "Gregg said that Norris had been acting strangely" is read by jumping back and forth in the chunk. In contrast to the first FU, this reading activity occurs in parallel while already typing the translation of "Gregg said that".

According to John's typing model, a typist would need 24 seconds to key in this sentence. If we subtract the 3 initial seconds in which the sentence was initially scanned, we measure 25 seconds translation production time vs. 24 seconds predicted typing time. The translation was thus approximately produced at the speed of an expert copyist, also with a predicted error of less than 5%. That is, the additional cognitive effort of the translation activity took place in parallel with the typing activity and did not require additional time. Johns' model for copying apparently also correctly predicts expert translators' typing speed in an unchallenged translation situation. However, gaze behaviour (and thus mental activities) are different in translation and in copying.

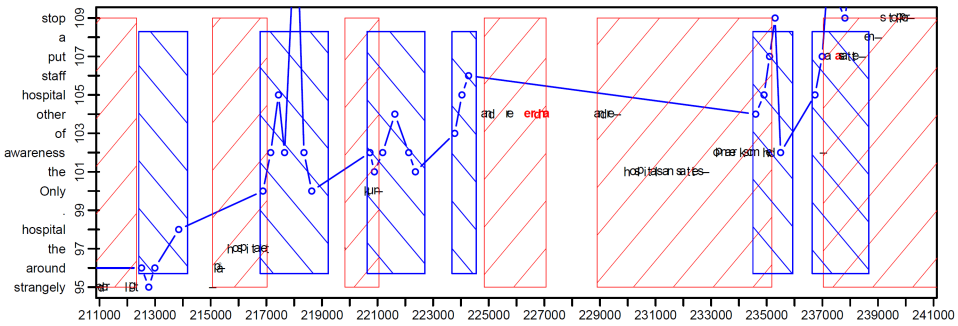

Fig. 3. The translation progression graph shows alternating reading and text production.

3.2 Alternating reading and writing

Figure 3 shows an example of mainly *alternating* translation activity, where the translator is either reading a ST segment or writing a piece of the TT. Figure 3 plots the translation progression of a sentence-final segment and the first words of the next sentence. The translator reads only a few words ahead of what she is currently translating. The produced translation is shown in example 3:

Example 3

> strangely around the hospital. Only the awareness of other hospital staff put a stop ...

Danish translation:

> underligt på hospitalet, kun [andre]andre hospitalsansattes opmærksomhed [a]satte en stopper ...

There is some reading activity (seconds 217-220) before the translator starts translating the second sentence. The two English sentences are collapsed into

one Danish sentence, connected by a comma. There is another scanning phase closely following the first one between seconds 221-225 just after typing "kun", which is the translation of "only". That is, the translator typed "kun" and presumably only then developed a strategy for reordering the translation of "the awareness of other hospital staff". Note the inversion into "other hospital staff[GEN] awareness" in the progression graph.

The translation in example 3 consists of 11 words and 82 characters and was typed in 30 seconds. Including the 6 typos - "andre" was first typed then deleted and then again typed and later "a" was typed and deleted – the typist model predicts 22 seconds to complete the typing. That is, while there might be approximately the same amount of ST reading in a parallel and in an alternating mode, the overall translation time is significantly longer in the alternating mode that in a parallel mode, since activities occur sequentially.

4 Discussion and Conclusion

In this paper we empirically underpin a hypothesis of Mossop (2003) and Ruiz et al (2005), that translation production may be based on a shallow understanding of the ST.

We compare two experimental settings, a copying task and a translation task. We record keystroke and gaze movements using the Translog software. In the copying task, a copyist reads an English text and types the same text on a keyboard, while in the translation task the text is translated into another language (Danish). In the translation task we observe both, "parallel" and "alternating" text production.

We find that text copying and translation activities may resemble each other in terms of typing speed and the number of fixations on the ST – the distribution of fixations is however different in both tasks. Our data show that translators look further ahead into the ST than copyists, both during parallel and alternating text production. Carl and Kay (2011) show that experienced translators operate more frequently in a parallel manner, while translation students resort frequently to the alternating mode.

Reading is far less steady than writing, the eyes jump over two sometimes three words, back and forth, until a piece of text is sufficiently understood to start typing out a translation. These reading patterns resemble in the parallel and in alternating mode. Whereas the alternating mode implies that the translator is either involved in ST understanding or in TT production, the observed reading patterns of 3 to 5 words ahead of the current point of text production does not suggest a deep or "complete" understanding of the ST.

From our examples we thus conclude that translators (of these texts) proceed preferably in a shallow mood which rather resembles text copying than a full text understanding.

From previous investigations it seems that more experience allows translators to work similar to a typist. A translator will aim at producing translations with minimal effort and minimal cognitive workload. Obviously a translator must first

read a ST passage when producing its translation, but usually s/he will try not to do more than that. That is, for producing the next TT word a translator will ideally and whenever possible only consult one (or a few) ST words, just enough to go on with the text production. Whenever the source and target languages are close in terms of conceptual and syntactic structure there will be a minimal lapse of time between reading of a ST words and the production of the translations. In such instances we are likely to observe a linear, almost word-for-word translation production where the typing activity occurs immediately after a ST word has been read. This translation pattern resembles those of figure 2. We take it that mental buffering and workload is minimized in this setting and productivity will basically depend on the typing skills and speed of the translator.

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