Looking at Eyes

Eye-Tracking studies of Reading and Translation Processing

Edited by

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Copenhagen Studies in Language 36
Samfundslitteratur

<|69|>
This applies to both the language import and the language export, and makes the import or export faster.

<0|

Segment 24

<0>Es wurden Änderungen an der Transporttechnologie vorgenommen mit dem Ziel, die Performance und die Durchführbarkeit des Sprachentransportes weiter zu verbessern.

<|75|>
Changes have been made to the transport technology and the user interface that improve both the performance and usability of the language transport tools.

<0|

Segment 25

<0>Zu Basis-Release 4.6C wurde der Sprachentransport komplett umgestellt, weil Sprachen nun auch mit dem SAP-Transportprogramm R3trans transportiert werden.

<|52|>
The language transport function has been changed completely in Basis Release 4.6C.

Eye movement behaviour across four different types of reading task

Arnt Lykke Jakobsen and Kristian T.H. Jensen

Abstract

A group of six professional translators and a group of six translation students read four similar texts on the same news topic while their eye movements were tracked. The first two texts were read with different reading purposes, (a) for comprehension and (b) with the intention of translating the text afterwards. Texts three and four were read while being simultaneously (c) translated orally and (d) translated in writing. It was found that professionals were faster than students. For both groups, task time, fixation frequency, gaze time and average fixation duration showed a consistent, linear progression from task to task. In the final task it was shown that the distribution of visual attention to the source text for students was higher than that for the target text, whereas professional translators prioritised visual attention to their own target text.

1. Background

Eye movements in reading have been studied intensively for decades (see e.g. Just & Carpenter 1980; Rayner & Pollatsek 1989; Rayner 1998; Hyönä *et al.* 2003; Radach *et al.* 2004) and several basic facts about eye movements in reading have been convincingly documented. We now know the typical duration and length of saccades and the typical duration of fixations, and we know that such factors as word familiarity (Williams & Morris 2004), word predictability (Frisson *et al.* 1999), word length and complexity (Kliegl *et al.* 2004; Bertram & Hyönä 2003; Rayner & Duffy 1986), lexical and/or syntactic ambiguity (Juhasz & Rayner 2003) all affect fixation duration. What we still know little about is how reading varies

according to reading purpose, or according to the way reading is sometimes combined concurrently with other language activities as in the case of oral and written translation. The main focus in reading research has been on lexical processing and on reading short strings of words, while less attention has been paid to eye movement behaviour during continuous reading, reading with different aims, or reading under different circumstances. There are numerous popular books on the benefits of scanning or skimming, and of being able to adapt one's reading speed to the purpose of reading, but not much research has been done on more specific types of reading purpose, reading of specific types of text, or reading while translating.

Our aim and interest was to study effects on eye movements of reading the almost identical texts for two different purposes: (a) for comprehension or (b) with a view to translating the text afterwards. We also wanted to study what differences there might be in visual attention to a text being read, depending on whether or not the reading of the text is accompanied by other language activities such as speaking aloud, or speaking or typing a translation of a text. We thought it would be fruitful to study the combination (c) of reading and speaking a translation more or less concurrently and (d) of reading and typing a translation more or less concurrently, by means of eye tracking equipment

Coming from the world of translation process research, we were particularly interested to see, first, if differences could be detected between a general-purpose reading of a text, aimed solely at comprehending text meaning, and a reading of the same (or a very similar) text while believing that it had to be translated subsequently. Secondly, we were curious to find out if reading a text under the conditions just mentioned would result in different degrees of visual attention to the text in comparison with the attention devoted to a text by a translator while speaking a translation of the text being read. Finally, we were interested to see how much translators working in the written modality would attend both to the text being translated (the source text) and to the (target) text they were typing, and how their visual attention would compare with that in the other tasks. If differences were found, we would look for probable causes of such differences. In our dreams, we were already fantasising about conclusions

that might have consequences for our pedagogical practice and change our way of teaching translation.

2. Experimental set-up and design

A Tobii 1750 remote eye-tracker was used to register the eye movements of six translation students and six translation professionals as they read four short English newspaper texts of approximately 200 words each, all on the same international news event (full texts in appendix A). Texts were displayed in 16 point Times Roman font and double spacing on a 17" LCD screen at 1280 x 1024 pixels. The average viewing distance aimed at was 60 cm from the screen, but no head or chin rest was used. The software used for display was Translog. Audacity was used to record the spoken output in Task 3.

When running experiments with a remote eye-tracker, there is a certain risk of losing data or of obtaining poor quality data. The very significant advantage that comes with not having to use a bitebar or a head or chin rest is counterbalanced by the risk that data will sometimes be imperfect. This is particularly critical if very accurate measurement is required. In the present series of experiments, all of which involved continuous reading of text with several hundred measurements for each task, we estimated that the odd local inaccuracy would have no negative effect on total averages, and as it turned out we discarded less than 10 % of our raw data.

Several standard tools were used to measure the orthographic, lexical and syntactic complexity of the four texts. It was stipulated that the texts had to be as authentic and as comparable as possible. The number of characters in the four texts varied only between 1086 and 1117; the number of words varied between 187 and 197, and the average word length varied between 4.35 and 4.87 characters. The only difference was in the number of sentences (8, 8, 7, 6). The type-token ratio was between 0.62 and 0.64. The number of highly frequent (K1) words was between 76 % and 79 % and the percentage of less highly frequent words (K2–K20) was between 17 % and 18 %. By the SMOG readability index, the texts scored between 12.5 and 15.

As a further means of neutralising any skewing effects caused by differences in the texts, we rotated the task-text combination systematically so that participant A performed Task 1 with Text 1, Task 2 with Text 2, etc.; participant B performed Task 1 with Text 2, Task 2 with Text 3, etc.

The task sequence was as follows:

Task 1: *Reading for comprehension* was a straightforward reading task where participants were asked to read the text 'for comprehension' in the same way they would normally read a news article of this kind. The task ended when participants signalled that they had finished reading. Their comprehension was not subsequently tested.

Task 2: *Reading in preparation for translating* was a reading task like Task 1, but here participants were told that they would be asked to translate the text after reading it. (Participants were in fact not asked to translate the text they had read in Task 2, but were asked to translate two of the other texts.)

Task 3: *Reading while speaking a translation ('sight translating')* required participants to combine reading of the text with producing a spoken translation of it into their native Danish. (For all participants, all translations were L2 to L1 tasks.) Sight translation is a hybrid genre in that written text is read and transformed by the translator/interpreter into the spoken modality. All of the participants had had some prior experience with this genre and immediately understood what the task involved.

Task 4: *Reading while typing a written translation* was a traditional written translation task. As in all the earlier tasks, text was displayed in Translog on the computer screen. In Task 4, however, the participants' written translation also appeared on the computer screen, in a split-screen window below the window in which the source text was displayed. In order to make it easier for us to analyse their recorded gaze data, participants were instructed to scroll the source text only once. Keystroke events were logged together with 'time-of-day' for each event in Translog. (These data are not relevant for the analysis presented here.)

In sum, the variables in the experimental design were as follows.

Independent variables: two different reading modalities (reading for comprehension and reading with a view to translation) and two different translation modalities (spoken sight translation and written translation). Language combination and direction: English into Danish.

Dependent variables: reading time (task time), number of fixations, total gaze time duration (including regressions), fixation duration, and transitions across 'areas of interest', the source and target text areas on the monitor screen (Task 4 only).

Controlled variables: texts, text type, text length, translator's profiles, experimental conditions, task sequence.

With a succession of four tasks that were always presented in the same sequential order and each of which involved reading of similar texts reporting the same event in similar language, a cumulative effect of priming from one task to the next was to be expected. Assuming such an effect, we expected to find relatively fewer, and probably also shorter, fixations (on repeated words) in later tasks.

Participants were asked to carry out all tasks at the speed with which they would normally work. No time constraint was imposed, but sight translation (Task 3) can be said to have a built-in speed norm, which may automatically have introduced an element of time pressure in this task.

3. Findings and analysis

Four measures from each of the tasks were compared: 1) task time, 2) the total number of fixations ('fixation count'), 3) the total duration of all fixations during execution of the task ('total gaze time'), and 4) the average duration of individual fixations. Furthermore, in Task 4, the number of transitions made between the source and target text areas were calculated and compared.

3.1 Task time

With respect to task time, it was found, as expected, that the group of professional translators, which included one interpreter, were faster on average in all the tasks than the group of students (Table 1).

Table 1. Average task times in seconds by task for professional translators and translation students.

Task times (seconds)	Professionals	Translation students
Task 1	40	61
Task 2	57	103
Task 3	154	204
Task 4	771	945

Another finding was that, for both groups, there was a very consistent increase in task time across the four tasks.

The average task time (reading time) for Task 1 was 40 seconds (range 23–59 s) for professional translators and 61 seconds (range 46–84 s) for translation students. With about 200 words in the texts, this means that professionals read five words per second (range 3–9) while students read three words per second (range 2–4).

The average task time (reading time) for Task 2 was considerably longer than for Task 1. Here, professionals spent 57 seconds on average (range 48-79),[1] while translation students spent 103 seconds (range 71–146).

The average task time for Task 3 was more than twice that for Task 2. There was considerable variance among participants within both groups, but again professionals were considerably faster than translation students, the average for professionals being 154 seconds (range 99–194 s) and 204 seconds for translation students (range 172–246 s.).[2]

The most remarkable task time difference was registered for Task 4, which generally took about five times longer than Task 3. The average for

[1] One outlier value (148 seconds) has been excluded. If included, the average reading time for professionals in Task 2 increases to 73 s.

[2] One outlier value (542 seconds) has been excluded. If included, the average task time for students in Task 3 increases to 261 s.

the group of professional translators was 771 seconds (range 589–982 s).[3] For the groups of translation students, it was 945 seconds (range 683–1161 s).[4]

3.2 Fixation count

The time difference between the execution of Tasks 1 and 2 was matched in all participants by a comparable difference in the number of fixations they made on the words in the texts. As expected, professionals had much fewer fixations than translation students overall, in both tasks (132 and 373 vs. 170 and 643).

In Task 1, the average fixation count for all participants (professional translators and translation students) was 145 (range 66-232). In Task 2, it was 223 (range 85-430). Typical gaze plots from Tasks 1 and 2 can be seen in Figures 1 and 2.

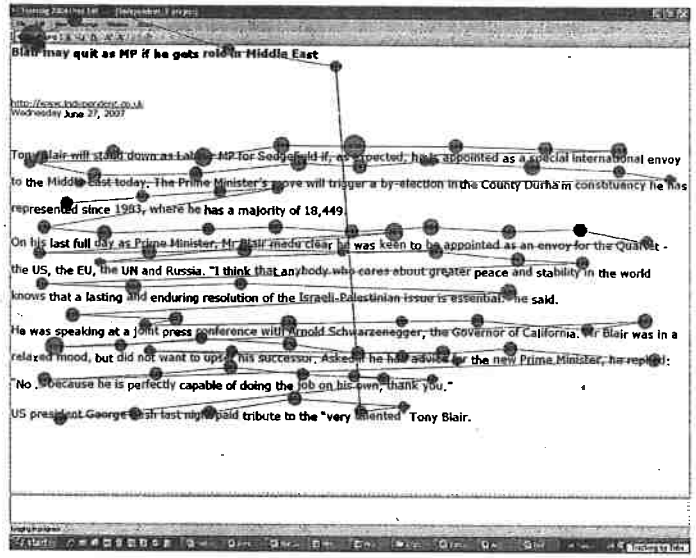

Figure 1. ClearView gaze plot of one participant's fixations on the text in Task 1

[3] One outlier value (1364 seconds) has been excluded. If included, the average task time for professionals in Task 4 increases to 869 s.

[4] One outlier value (2609 seconds) has been excluded. If included, the average task time for students in Task 4 increases to 1222 s.

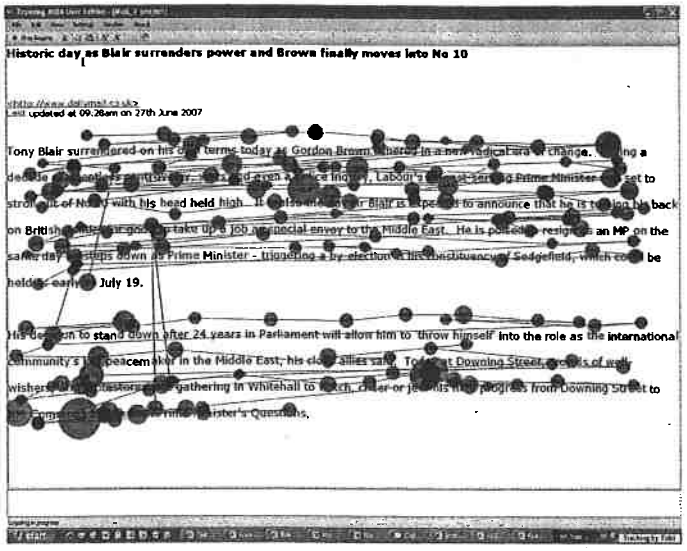

Figure 2. ClearView gaze plot of one participant's fixations on the text in Task 2

The average fixation count in Task 3 for all twelve participants was 520 (range 305-850) (see Figure 3), more than twice the count in Task 2.

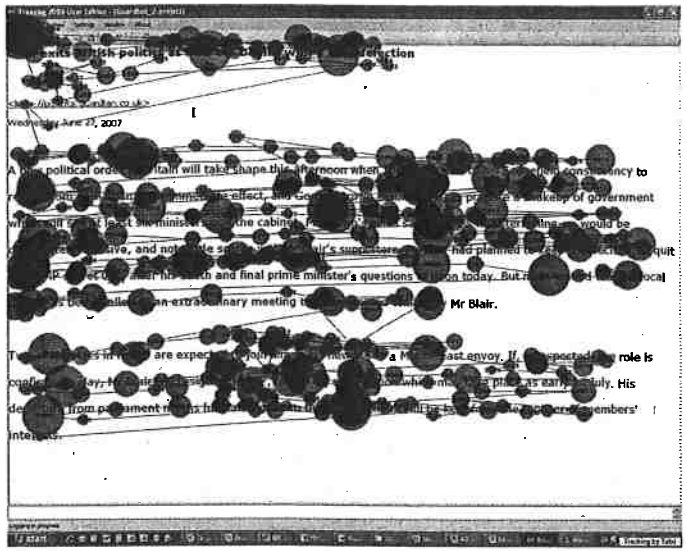

Figure 3. ClearView gaze plot of one participant's fixations on the text in Task 3

The largest number of fixations occurred in Task 4. Figure 4 is a typical gaze plot representation from this task showing a veritable smear of fixations.

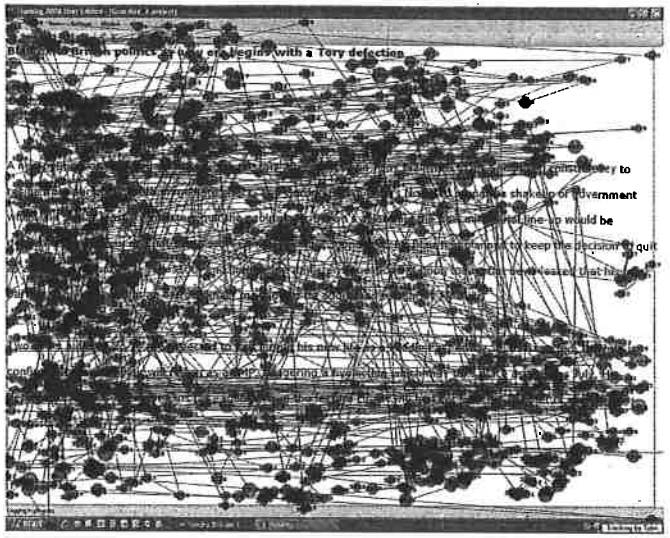

Figure 4. ClearView gaze plot representation of one participant's fixations in Task 4.

In Task 4, the average number of fixations increased to 1590 (range 1062–2680),[5] about three times the count in Task 3. Proportionally, this increase in the fixation count was less than the increase in task time, but it was still very considerable and much greater than expected.

After dividing the screen into separate 'areas of interest', one for the source text area and another for the target text area, it was possible to calculate the number of fixations in each area and the number of transitions from one area to another.

In the source text area, it was found that the average number of fixations was 708.[6] Visual attention to the participants' own target text involved even more fixations than on the source text with an average of

[5] A lower (723) and an upper outlying value (5795) have been disregarded. If included, the average was 1893.

[6] If outlying figures are included, the average was 895.

882.[7] The distribution of visual attention to the source and target text areas showed an interesting group difference. Professional translators had more than 50 % more fixations on the target text than on the source text (958 vs. 627), whereas translation students had fewer fixations on their target text than on the source text (729 vs. 869).

3.3 Gaze time

The total duration of all fixations throughout the execution of the four tasks showed a progression similar to that already found with respect to task time and fixation count. The average for all participants in Task 1 was 30 seconds, increasing to 40 seconds in Task 2, to 120 seconds in Task 3, and to 454 seconds in Task 4, with 195 seconds in the source text area and 259 in the target text area. The figures are summarised by group in Table 2.

Table 2. Average gaze times in seconds by task for professional translators and translation students.

Average gaze times (seconds)	Professionals	Translation students
Task 1	29	31
Task 2	33[8]	47
Task 3	115	127
Task 4 (source text area)	145	255
Task 4 (target text area)	288	223

The group difference that was found for the number of fixations on the source and target text areas also emerged in the gaze time data. Professionals looked considerably longer at their target text than at the source text, whereas translation students spent more time looking at the source text than at their target text. For all twelve participants, the increase in gaze time was remarkably consistent across the four tasks, as appears from Figure 5.

[7] 998, if outliers are included.
[8] 51, if one outlier is included.

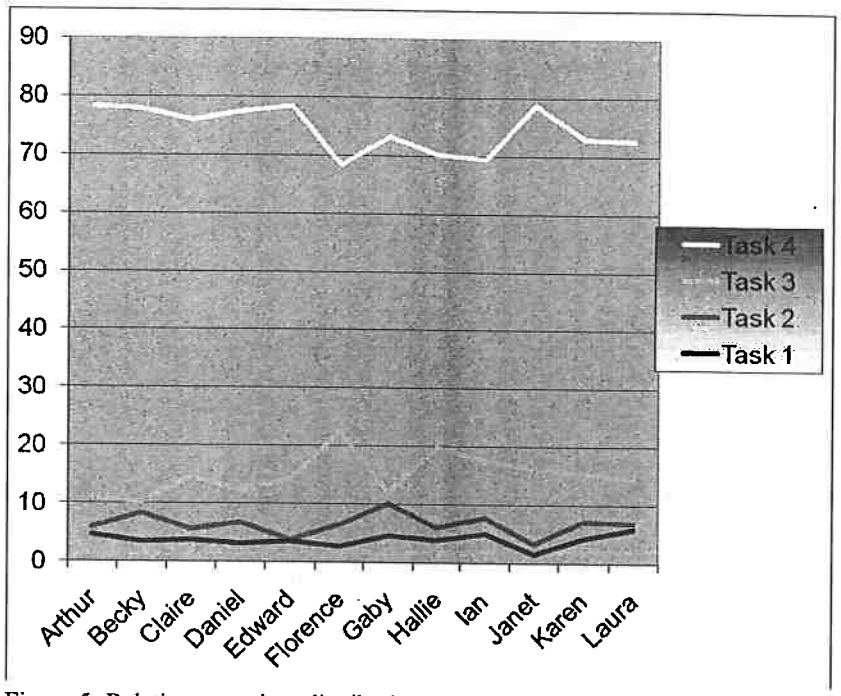

Figure 5. Relative gaze time distribution across four tasks for all 12 participants (for the sake of anonymity all names have been changed).

By comparing task time and gaze time, we were able to calculate how much of the total task time participants looked at the screen (Table 3). Saccades are generally found to last between 20 and 35 milliseconds (Rayner & Pollatsek 1989: 113) and consequently constitute some 10 to 15 % of reading time. The percentage figures in Table 3 should therefore be increased by 10 to 15 %. The fact that the difference between task time and gaze time was found to be sometimes only around 50 % (for the group of translation students)[9] suggests that either the students' gaze wandered away from the screen more often than was the case with professional translators or else that, for whatever reason, there were more missing gaze data in this group.

[9] NB. The values in the two rows for Task 4 should be summed, as each figure only represents visual attention to one half of the screen.

Table 3. Average gaze times in per cent of total task time by group

Gaze time (proportion of task time)	Professionals Gaze/Task time (seconds)	% gaze	Translation students Gaze/Task time (seconds)	% gaze
Task 1	29/40	72.5	31/61	50.8
Task 2	33/57	57.9	47/103	45.6
Task 3	115/154	74.7	127/204	62.3
Task 4 (source text area)	145/771	18.8	255/945	27.0
Task 4 (target text area)	288/771	37.4	223/945	23.6

3.4 Duration of fixations

Studies of word fixations have shown that they typically last 200 to 250 ms and that their duration varies according to a vast array of parameters. In the EU Eye-to-IT project, an application has been built which triggers an online translation prompt if the user's fixation on a word exceeds a specified threshold duration. This functionality is based on the so-called 'eye-mind assumption' (Just & Carpenter 1980) that there is a high correlation between long fixation durations and effortful processing. By displaying a prompt in such instances, the aim is to reduce the processing effort, speed up the translation process and ideally also to improve the quality of the translation.

In our data the variation across groups was insignificant, but there were interesting differences by task. Our findings are summarised in Table 4.

Table 4. Mean fixation duration in milliseconds for all participants by task

Fixation duration (ms) by task	Average for all participants
Task 1	205
Task 2	205
Task 3	235
Task 4 (source text area)	218
Task 4 (target text area)	259

3.5 Transitions (Task 4)

For the group of professionals, the average number of transitions from the source-text area to the target-text area (or back) was 190. For students, it was 259.[10] With average task times of 771 and 945 seconds for the two groups, this means that both professional translators and translation students made a transition about once every four seconds.

3.6 Statistical analysis[11]

A tentative statistical paired samples t test of fixation count findings suggested that all the mean differences across the four tasks (for all participants) were significant. The mean fixation count increase from Task 1 to Task 2 was highly significant ($p < 0.001$, $t = -5.558$, and $df = 11$). Likewise, the mean fixation increase from Task 2 to Task 3 was significant with $p < 0.01$, $t = 4.485$, and $df = 11$. The increase in the fixation count from Task 3 to Task 4 was also significant with $p < 0.01$, $t = -3.378$, and $df = 11$. These differences were all significant regardless of whether outlying values were included or excluded. Finally, the increase in the fixation count from Task 3 to the count for the source-text area in Task 4 also proved significant with $p < 0.05$, $t = -2.671$, $df = 11$. The increase in the fixation count across the two areas of interest in Task 4 was not significant.

None of the observed differences in total gaze time reached statistical significance.

The mean fixation duration increase from Task 1 to Task 3 and from Task 2 to Task 3 were both close to significance with $p = 0.074$ ($t = -1.978$, $df = 11$) for the increase from Task 1 to Task 3, and $p < 0.05$ ($t = 3.025$, $df = 11$) for the increase from Task 2 to Task 3. However, the increase in mean fixation duration within the two areas of interest in Task 4 turned out not to be significant.

A one-way ANOVA analysis by group across all tasks showed that the mean fixation count for translation students was significantly higher than that of professionals with $p < 0.01$, $F_{1,10} = 12.735$. The recorded average duration of fixations was systematically longer in all tasks for the

[10] 367 if outliers are counted.

[11] We would like to acknowledge here the assistance we have received with the statistical analysis from Selina Sharmin, University of Tampere.

group of professionals than for the group of translation students, but this difference did not reach significance. For both groups, fixations in the target-text window (in Task 4) had longer duration (259 ms) than fixations in the source-text window (218 ms), but this difference was not statistically significant. No other significant differences by group were found.

4. Discussion

4.1 Task time

The increase in reading time from Task 1 to Task 2, where the only difference was the different expectation raised in participants from the instruction to Task 2 that they would be asked to translate the text later, suggests that a fair amount of pre-translation probably enters into the reading of a text as soon as it is taken to be a source text for translation.

The increase in task time from Tasks 1 and 2 to Task 3 is most obviously explained by the requirement to produce a spoken translation of the text immediately upon reading a phrase or sentence in the text. All participants understood the task to mean that a sight translation (also known as a 'prima vista' translation) does not allow the translator time to read the full text before starting to produce the spoken translation. Though the input speed (reading speed) is controlled by the translator, which makes the task different from the situation in simultaneous interpretation, sight translation nevertheless introduces an element of time pressure somewhat similar to that found in simultaneous interpretation because the translators know that listeners expect the product to be presented in fluent, connected speech.

The increase in task time from Task 3 to Task 4 gives rise to a number of questions that cannot be answered here. For instance, there is no doubt that our participants were all able to speak words faster than they could type them, but we did not measure this difference, which, we believe, in any case only accounts for a small portion of the difference in task time. When participants typed in Task 4, their production speed was often about 60 % of the speed with which they spoke in Task 3, but the pauses with which they interrupted their typing were much longer than the pauses they made in the oral translation in Task 3. This may be because written

translation is typically associated with a high level of textual perfection with regard to target-language standards and a high level of accuracy in the way it represents the meaning of the source text. Even though translators did not have access to external information (from dictionaries or Internet sources), the extra time may still have been invested in optimising the quality of the translation. In the present context, however, this potential quality increase was not examined. In investigating variations in visual attention, we were primarily interested in identifying differentiation caused by differences in reading purpose and/or differences caused by concurrent processing that had to be integrated with the reading process.

4.2 Fixation count

The mere instruction to read a text with a view to translating it afterwards caused participants to have significantly more fixations; in line with Just *et al.*'s eye-mind assumption (1980: 330–331) it also resulted in more processing than was the case following an instruction to read a text for comprehension.

Contrary to our expectations, there was no clear evidence from the data obtained for Task 2 that fixations were concentrated on certain areas that were being pre-translated during the reading. (Possible instances in the gaze plot shown in Figure 2. might be 'jeer' in 'cheer or jeer' and 'the Commons'.) It seemed more as if the instruction in Task 2 triggered slower and perhaps more careful reading, causing fixations to occur more densely across the whole text. Since participants did not actually translate the text they read 'with a view to translating it later' in Task 2, it was not possible to compare details in their reading in Tasks 2 and 4, where they translated a different text. All we were able to observe was that our twelve participants had more fixations in Task 2 than in Task 1 and that the increase in fixations in comparison with Task 1 appeared to be distributed evenly across the whole text rather than being concentrated on selective trouble spots expected to cause translation problems.

The new requirement in Task 3 to translate the text displayed on the screen resulted in a major change in participants' eye movement behaviour caused by the need to not only comprehend the text but also to monitor translation progress. In the sight translation task, additional fixations were

necessary because the eyes were required not only to feed the brain with input for meaning construction, but also to supply the brain with online monitoring information about what portions of text had been satisfactorily covered by the spoken translation output and what elements remained to be dealt with. The additional eye movement was caused by the need to ensure management (coordination) of comprehension and text production. Additional gaze activity was required to ensure that the information represented in the participant's flow of speech was dynamically matched to the string of text on screen. Furthermore, the requirement to produce a complete spoken translation of the text (in contrast to Task 2) caused participants to re-read text they had understood perfectly, but for which they did not immediately succeed in producing an adequate translation. This caused all participants to repeatedly have regressive fixations on words that had already been fixated (and presumably fully understood), but regressions were apparently considered necessary in order to ascertain that all words and associated meanings had been properly rendered in the spoken translation.

The obvious main reason for the huge increase in Task 4 is that here, unlike Tasks 1 to 3, participants' eyes were reading and monitoring two texts, not merely a source text as in Tasks 1 to 3, but also their own emerging translation of this text (into Danish).

The increase in the fixation count for the source-text area in Task 4 as compared with the count in Task 3 amounted to almost 40 %. Some of this substantial increase can undoubtedly be put down to the slower and more meticulous working habits that seem to be intrinsic to written translation. It is also likely that the addition of a processing outlet tends to break down concurrent input processing into smaller segments. However, it should be noted that much of the increase was caused by the visual disorientation that resulted from the translators' need to constantly shift visual attention between two texts. Though all of our participants had strong typing skills, our recordings of their eye movements clearly showed that all, including touch typists, monitored their typing visually, either by occasionally looking at the keyboard or by looking at their own emerging text on the screen. No participant typed the target text while looking only at the source text. This meant that they made a considerable number of transitions between the two texts, and transitions frequently resulted in the

eyes not travelling back to the optimal target word, but rather to the target area, so that a certain amount of re-reading was necessary before the target word or phrase had been located. Here we wish only to point to the phenomenon based on the general count of fixations. Further study will be necessary in order to determine the exact extent and potentially quite disruptive nature of such reorientation efforts.

In parallel with our interpretation of what caused the increase in the fixation count in Task 3, we interpret the increase in the fixation count in the target-text area in Task 4 as being caused by the visual text monitoring that is necessary as a means of managing and controlling concurrent written text production.

4.3 Gaze time

It is perhaps not surprising that gaze time relative to task time (see Table 3) was higher in Tasks 1 and 3 than in Task 2. Tasks 1 and 3 are both 'eyes-wide-open' tasks, whereas Task 2 may have caused some participants to occasionally look away or even close their eyes while reflecting on a potential translation problem.

The most striking difference in the distribution of gaze time across groups concerned the allocation of visual attention to the source and target text areas. In line with previous findings (Jakobsen 2002), professionals were found to devote about twice as much time to their own text as to the source text, whereas translation students spent more time looking at the source text than at the their own target text. This is evidence that professional translators generally invest much more effort on end-revision of their translations than do translation students. It is also a likely reflection of translation students struggling more with comprehending an L2 source text than professionals.

4.4 Fixation duration

Reading fixations, whether for comprehension (Task 1), with a view to translating (Task 2) or on the source text as part of a written translation task (Task 4), were generally short (205–218 ms). By contrast, fixations in Task 3 and in the target text area (Task 4) were generally longer (235–259 ms). This indicates that monitoring reading while engaging in a concurrent task

(speaking or typing a translation) simultaneously causes both more fixations and fixations with longer average duration, so that total gaze time is increased owing to both these parameters.

In spite of the probable priming effect as a result of the topical and lexical similarity of the four texts, which was expected to lead to fewer and shorter fixations, the opposite was found. Both the number of fixations and the average duration of fixations were higher in Tasks 3 and 4 (source text area) than in Tasks 1 and 2. Clearly, the increases from Task 1 to Task 2, from Task 2 to Task 3 and so forth were task-related. Fixation durations were the same in Tasks 1 and 2, but higher both in Tasks 3 and 4 (source text area) because they required a different kind of reading that included visual monitoring of the progress of translation.

4.5 Transitions (Task 4)

For the group of professionals, the average number of transitions was 190. For students, it was 259 (367, if outliers were counted). All of these transitions are part of the alignment and monitoring process that characterises translation, but each transition requires the eye to spend time finding and returning to the point at which the previous text was exited. This process, involving transitions every three or four seconds from source text to target text and back, causes translators to frequently fixate and re-read several words before getting to the intended target segment. There is no doubt that the increase in the number of fixations in Task 4 was caused mainly by there being two visual texts to attend to, but at least in part also by the confusion and disorientation caused by frequent transitions between them.

5. Conclusion

The difference between Tasks 1 and 2 showed that reading purpose had a clear effect on eye movements and gaze time. The instruction to read a text with a view to translating it afterwards caused participants to undertake considerable processing additional to what was the case following an instruction to read a text for comprehension. Without exception, the

increase in the number of fixations across the four tasks in the experiment turned out to be statistically significant.

Task 3 required more time, more fixations, and was more cognitively demanding than the earlier tasks for two reasons. A sight translation had to be produced of the source text displayed on the screen, and while translators were in the process of articulating the words, their eyes were working to coordinate comprehension and translation processes; this involved both reading source text and monitoring what portions of text had been dealt with, and what portions were still waiting to be translated.

The main conclusion drawn on the basis of the Task 4 data was that one reason why written translation was slow was that it involved very disruptive reading, with frequent transitions between source and target texts.

Looking back at the experiment, we feel a task should have been included in which participants were simply asked to read a text out loud. This would have allowed us to know more clearly how much additional eye movement was caused by a concurrent language production activity that did not involve translation. This would also have allowed us to study any differences arising from the translation parameter in Task 3.

So there is more work that needs to be done before we can connect fantasy with reality and meet our practical aim of reforming pedagogical practices to match our better understanding of translation and our dreams of developing intelligent support applications for translators. What we need most of all is to further explore the greatest research challenge we are faced with: understanding and modelling not only the way translators read, but the whole way in which the bilingual human brain succeeds in managing and coordinating the intricate processes we call translating.

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Appendix A

Historic day as Blair surrenders power and Brown finally moves into No 10.

Tony Blair surrendered on his own terms today as Gordon Brown ushered in a new radical era of change. Ending a decade of relentless controversy, wars and even a police inquiry, Labour's longest-serving Prime Minister was set to stroll out of No 10 with his head held high. It is also the day Mr Blair is expected to announce that he is turning his back on British politics for good to take up a job as special envoy to the Middle East. He is poised to resign as an MP on the same day he steps down as Prime Minister – triggering a by-election in his constituency of Sedgefield, which could be held as early as July 19.

His decision to stand down after 24 years in Parliament will allow him to 'throw himself' into the role as the international community's key peacemaker in the Middle East, his close allies said. Today at Downing Street, crowds of well-wishers, and protesters were gathering in Whitehall to watch, cheer or jeer his final progress from Downing Street to the Commons for his final Prime Minister's Questions.

http://www.dailymail.co.uk
Accessed June 27, 2007

Number of words: 197. Number of characters with spaces: 1.102

Finally, Blair exits the stage

Tony Blair will say farewell to Downing Street and domestic politics today, bringing to an end a remarkable decade in power which began with extraordinarily high hopes but ended with opinion divided over his legacy to the country. After his last appearance at the dispatch box at Prime Minister's questions Mr Blair will return to Downing Street to make an emotional farewell to his staff, some of whom have been with him since he became Leader of the Opposition in the heady days of 1994 and the birth of New Labour.

Mr Blair, Labour's most successful leader after an unprecedented three election victories, making him – alongside Margaret Thatcher – one of the dominant political figures since the war, will drive up The Mall to Buckingham Palace with his wife Cherie to tender his resignation to the Queen. In contrast to his arrival as Prime Minister in May 1997 when Downing Street was lined with handpicked Labour Party members cheering, and waving Union flags, Mr Blair will make a low-key exit. Today it will be photographers, not supporters, recording his reluctant departure.

http://www.telegraph.co.uk
Accessed June 27/, 2007

Number of words: 187. Number of characters with spaces: 1.115

Blair exits British politics as new era begins with a Tory defection

A new political order in Britain will take shape this afternoon when Tony Blair flies to his Sedgefield constituency to resign from parliament with immediate effect, and Gordon Brown enters No 10 to prepare a shakeup of government which will see at least six ministers quit the cabinet. Mr Brown's allies said the new ministerial line-up would be deliberately inclusive, and not settle scores with Mr Blair's supporters. Mr Blair had planned to keep the decision to quit as an MP secret until after his 318th and final prime minister's questions at noon today. But news leaked that his local party was being called to an extraordinary meeting to be addressed tonight by Mr Blair.

Two of his aides in No 10 are expected to join him in his new life as a Middle East envoy. If, as expected, the role is confirmed today, Mr Blair will resign as an MP, triggering a byelection which may take place as early as July. His departure from parliament means his earnings from the lecture circuit will be kept from the register of members' interests.

http://politics.guardian.co.uk
Accessed June 27, 2007

Number of words: 194. Number of characters with spaces: 1.106

Blair may quit as MP if he gets role in Middle East

Tony Blair will stand down as Labour MP for Sedgefield if, as expected, he is appointed as a special international envoy to the Middle East today. The Prime Minister's move will trigger a by-election in the County Durham constituency he has represented since 1983, where he has a majority of 18,449.

On his last full day as Prime Minister, Mr Blair made clear he was keen to be appointed as an envoy for the Quartet – the US, the EU, the UN and Russia. "I think that anybody who cares about greater peace and stability in the world knows that a lasting and enduring resolution of the Israeli-Palestinian issue is essential," he said.

He was speaking at a joint press conference with Arnold Schwarzenegger, the Governor of California. Mr Blair was in a relaxed mood, but did not want to upset his successor. Asked if he had advice for the new Prime Minister, he replied: "No ... because he is perfectly capable of doing the job on his own, thank you."

US president George Bush last night paid tribute to the "very talented" Tony Blair.

http://www.independent.co.uk
Accessed June 27, 2007

Number of words: 196. Number of characters with spaces: 182

Using pupillometric, fixation-based and subjective measures to measure the processing effort experienced when viewing subtitled TV anime with pop-up gloss

Colm Caffrey

Abstract

Eye movements and pupil size of twenty participants were recorded while they were watching excerpts from a TV anime subtitled in English with either standard subtitling, or subtitling that included the use of pop-up gloss. The fixation-based and pupillometric data were used, in conjunction with a questionnaire-based subjective scale, to measure the processing effort that participants experienced. The reported experiment also provides data on the feasibility of using pupillometric data as a measure of processing effort with subtitled audiovisual (AV) content. Overall the results suggest that the use of pop-up gloss did increase the amount of processing effort experienced by participants, indicated by results such as the increased percentage of skipped subtitles and lower word fixation probability of participants who viewed the excerpts with pop-up gloss. The results also suggest that pupillometry may be a suitable measure of processing effort with AV content, when a trial-aggregated coarse method is used.

1. Introduction

Watching subtitled AV content is a complex task, involving the processing of information from four overlapping semiotic channels of information, visual verbal, visual nonverbal, audio verbal and audio nonverbal. While there are general rules of thumb that subtitlers follow, for example that two lines of subtitle text should contain a maximum of 32 characters and be displayed for a maximum of six seconds, DVD technology has allowed