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Fascinatin' Rhythm **– and Pauses in Translators' Cognitive Processes**

Abstract

The Monitor Model fosters a view of translating where two mind modes stand out and alternate when trying to render originals word-by-word by default: shallow, uneventful processing vs problem solving. Research may have been biased towards problem solving, often operationalized with a pause of, or above, 3 seconds. This project analyzed 16 translation log files by four informants from four originals. A baseline minimal pause of 200 ms was instrumental to calculate two individual thresholds for each log file: (a) A low one – 1.5 times the median pause *within* words – and (b) a high one – 3 times the median pause *between* words. Pauses were then characterized as short (between 200 ms and the lower threshold), mid, and long (above the higher threshold, chunking the recorded activities in the translation task into *task segments*), and assumed to respond to different causes. Weak correlations between short, mid and long pauses were found, hinting at possible different cognitive processes. Inferred processes did not fall neatly into categories depending on the length of possibly associated pauses. Mid pauses occurred more often than long pauses between sentences and paragraphs, and they also more often flanked information searches and even problem-solving instances. Chains of proximal mid pauses marked cases of potential hesitations. Task segments tended to happen within 4–8 minute cycles, nested in a possible initial phase for contextualization, followed by long periods of sustained attention. We found no evidence for problem-solving thresholds, and no trace of behavior supporting the Monitor Model.

Keywords

Baseline pause; individualized thresholds; cognitive processes; problem solving; hesitation; task segments; rhythm; Monitor Model

1. Introduction

Tirkkonen-Condit (2005) and Tirkkonen-Condit et al. (2008) drew from previous scholarship to suggest the existence of a **Monitor Model** that would regulate online quality monitoring of translation solutions through the translation process.[2] This Monitor is portrayed as a mechanism or automaton that would control one's own translated output. The Monitor would restrain or rule out incorrect or unwanted formal equivalents and literal versions yielded by a purported word-by-word default rendering procedure. In order to achieve this, the Monitor would switch the workings of one's own mind from a 'shallow processing' mode that proves temporarily inadequate into a deeper problem-solving mode, and back. The Monitor Model has been further elaborated by at least Carl/Dragsted (2012), Schaeffer/Carl (2013, 2014), and Carl et al. (2016) and it seems to be gathering momentum.

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2 The choice of the term *Monitor Model* was rather infelicitous, for Krashen (1977) had used it in the neighbouring discipline of language acquisition to mean something else and in Translation Studies at least Kiraly (1995: 29-31) and Campbell (1998: 128) had already used it in Krashen's sense.

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The Monitor Model has also been subject to some criticism. Halverson (2015) has expressed her reservations regarding the concept of **literal translation** to forward the notion of **default translation** instead. Briefly, literal translation would refer to text segments in different languages where the symbolic codification is the closest possible, whereas default translation would refer to the first one that comes to mind, whether literal or not. Jääskeläinen (2016: 101) suggests that stress and cognitive load might compromise the workings of the Monitor and even lead to failure, thereby casting some doubts on its assumed mechanical nature. Muñoz (2016) describes it as a paramount example of the mind-as-computer metaphor and argues against some aspects of the model. Of course, scientific models need not necessarily aim to stand for, or depict, a chunk of reality; they may just fit empirical data with no claim as to their (psychological) reality. In what follows, however, we would like to argue that the Monitor Model might not only lead to missing important insights into the translation process, but also to distorting the analysis of how it unfolds.

2. Analyzing the translation process

Many TPR projects in the last 20 years have focused mainly or solely on problem solving. Any analysis of problem-solving strategies is "[...] strictly linked to the concept of translation to which we subscribe and to the notion of what constitutes a translation problem [...]" (Wotjak 1997: 102). In many TPR projects, translating is often assumed to consist of "a complex series of problem-solving and decision-making processes" (House 2000: 150) or else the whole translation task is envisioned as an ill-defined problem (e.g., Sirén/Hakkarainen 2002: 72). Some research methods, such as TAPs, may have even biased researchers towards seeking translation problems *and nothing else:* translation stretches where no problem is found are often thought of as periods of **uneventful** or 'unmarked' processing. Such sharp distinction between problem-solving and a word-by-word default rendering procedure also features in Tirkkonen-Condit's (2005) Monitor Model (criticism in Muñoz 2014: 23-25). Jakobsen (2016), however, shows that a detailed analysis of keylogging transcripts may yield richer insights about what is going on in translators' minds when at task.

Concurrent cognitive models of writing also draw "heavily on expert-novice and artificial intelligence traditions and compared composing processes with problem solving" (McCutchen et al. 2008: 554). Writing process research often distinguishes between subtasks such as planning, revising, and transcribing. Here *transcribing* refers to basic writing skills involved in the "physical" activity of handwriting or typing (e.g., Berninger 2004). Such subtasks are thought to compete for limited cognitive resources, although transcription never drew much attention, "due to a widely shared belief that transcription in adults was so thoroughly automated that it would not have any significant impact on other writing processes and could safely be ignored" (Hayes 2012: 371). Nevertheless, evidence to the contrary accumulated in the last decade and now Hayes (2012: 372) thinks that transcribing "[...] must be accounted for in modelling all writers." The same line of thinking seems to sustain Muñoz's (2009) study on typos in translation.

Contrasts between translators' purported marked and unmarked processing, and between writers' alleged unproblematic transcription behavior vs problem solving are equally overlooked when pause thresholds are customarily set at 2 and 3 seconds in writing and TPR. In TPR, 3-second pauses are usually the touchstone to spot interruptions of the typing flow where subjects may be addressing potential translation problems. As in the case of TAPs, this arbitrary decision may have fostered a bias: In setting such relatively long pauses, researchers may have dropped potentially interesting observations in assumed unproblematic or uneventful text stretches out of focus. For instance, Lacruz et al. (2012) concluded that higher densities or clusters of 'shorter' pauses (.5–2 seconds) pointed to higher cognitive loads. Koponen et al. (2012) found that variations in time (in seconds) spent on post editing text (in words) were associated positively with higher cognitive efforts. Often, slower time per word is not due to slower key pressing – many typing movements are automatized – but rather to longer 'micro level pauses' at relevant points, such as those between syllables and prefixes.

Immonen (2011: 236) distinguishes between macro and micro level pauses and, in doing so, she raises a fundamental question in our research – what exactly is a pause? Schilperoord (1996: 9) thinks of pauses as "behavioral reflections of the cognitive processes involved in changing attentional states." For Hayes (2012), a pause is any break to reallocate cognitive resources in order to plan further writing or to write what has just been planned. If active monitoring is necessary throughout the translation process (Tirkkonen-Condit et al. 2008: 2), could we find empirical evidence in keylogging transcripts about monitoring activities that are not necessarily equal, or related, to problem solving? In other words, is problem solving the only interesting phenomenon that can be apprehended by studying keylog transcripts?

The Monitor Model seems to fit in a larger, orderly, computational picture of the translation process. Schilperoord (1996: 4-5) suggests that the interplay between actions, text features and pauses may be considered to yield cognitive rhythms. This may lead to distinguish translation process phases such as **orientation** and **revision**, clearly set apart by observable boundaries such as pressing the first or the last key (Jakobsen 2002). Stipulating that an initial orientation phase ends when the first key is pressed, however, is likely to be an experimental artifact: (1) Carl et al. (2011: s.p.) point out that "[t]he first keystroke is likely to be preceded by a short period of 'local' preparation that should ideally count as part of the drafting phase;" and (2) such orientation might well extend beyond that arbitrary point and into the first paragraphs of the original. On the other hand, long pauses assumed potentially to signal problem-solving activities are also used to break down the process into chunks. Jakobsen's (2002) notion that such chunks with production and editing activities may yield recursive patterns is worth exploring in several ways.

A translation automaton should always yield identical results for the same input whereas in humans, translation subtasks and processes such as planning, motor control, task switching, and assessment processes are likely to undergo variations due to personal, situational, and environmental factors (Muñoz 2016). Breedveld (2002) had already warned that, when translating, people do not do the same thing all the time. According to Breedveld, cognitive activities during translating differ through time, and the process has stages that differ from one another with respect to both their aim and the distribution of activities. Breedveld (2002: 231) further argued that such unevenly distributed activities are not performed at random, but in cohesion with one another, so that there should be a strong functional dependency between activities. In brief, cognitive activities will change because of the unfolding interaction of the translator with the text and the environment.

Potential variations in translators' behavior that might shine a different light on their cognitive processes may also have gone unnoticed due to some customary theoretical and experimental decisions. For example, short texts for short experimental tasks help researchers to reduce data to manageable volumes. Nevertheless, they may also hide whether subjects translate at different speeds later on, and whether observed behavior would be the same further down the source text or target text written so far. What follows is a report on an exploratory study of the Inputlog transcripts of the translations of four originals, carried out by four M.A. translation students. The goal was to look for variations such as those mentioned above. Since this was a preliminary, observational study, it explored two general research questions in keylogging transcripts of translation tasks:

1. Can transcripts with pause thresholds lower than 3 seconds yield clear information about behavioral phenomena to be reasonably associated with cognitive processes other than problem solving?
2. Are there other recorded regularities of behavioral phenomena that point to progressions of any kind throughout a translation task session?

3. Materials and methods

3.1. Subjects and texts

Two female and two male students with the fictive names of Ana (A), Gaspar (G), Marco (M) and Rosa (R), aged 23, 22, 22, and 24, respectively, carried out the translations. They were all right-handed, had been born and raised in middle-class Spanish monolingual environments in Gran Canaria, had graduated from the local university in a B.A. on Translation & Interpreting prior to joining the M.A. program, and English was their L2. Rosa was the only fluent touch typist, whereas Ana was the worst typist and displayed poor computing skills. Gaspar and Marco were in between the other two, with Gaspar standing out as a competent computer user (e.g., mainly using shortcuts instead of the mouse) and Marco excelling in information search. The students were trained to translate with Inputlog and used it in ca. six 1-hour class sessions a week from two different translation courses.[3] They also used it in some additional translating sessions on their own, at their homes. By the end of each session (in class and at home), they uploaded their work and the Inputlog files to an online repository for the course.

By the end of the semester, permission was requested and obtained from all four informants to use their anonymized class data for research purposes. In the circumstances, there were plenty potential transcripts to study, and four originals were chosen with the only requisites that (a) all four students would have translated it, and that (b) they should be quite different from each other. The originals were: (T1) a selection of short, independent pieces of news from the section "Politics this week" of the print edition of *The Economist,* 3 October 2015;[4] (T2) U.S. President Barack Obama's election victory speech (4 November 2008), meant to be read or said aloud; (T3) a practical, expository, online text – namely, a New Zealand tourist guide at WikiVoyage;[5] and (T4) the English version of Gabriel García Márquez´s *"Un día de estos"* [One of these days], a flash fiction narrative.[6] Table 1 shows that these texts, so different in nature, content, and circumstances, were all quite similar in difficulty in many respects, with T3 shorter in words and T4 longer and slightly easier. Beyond established parameters such as sentence length, type/token ratio, lexical and propositional density, clauses and verbs per sentence, other parameters were checked, that are not so well known but also present in the literature, such as vague and abstract words, negated verbs, and intra-, inter-sentential and textual cohesion. Finally, several customary parameters were split into different indicators, such as average frequency of unique and repeated full words, and some new ones were added, such as words unrecognized by our application's 10,000 lemma lexicon of frequent full words, cognates, false friends, and density of quantification, which seem specially fit to apprehend particularities of text difficulty for translators.[7]

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3 The training consisted of basic hands-on instructions on how to use the program, followed by one fifteen-minute session of actual usage, and the display of the output and some basic analyses; actual usage in the first week sessions was also used to make sure informants were using the program properly and was discarded as research materials.

4 http://www.economist.com/news/world-week/21670081-politics-week. At the time of translating it, they were last week's news.

5 https://en.wikivoyage.org/wiki/New_Zealand

6 http://www.classicshorts.com/stories/ootdays.html. Students did not know they were translating back into Spanish from a translation. The only revealing feature, the name of a character mentioned in the short story, was changed from *Aurelio Escovar* to *Percival Stutton*

7 Data were obtained with an online application developed by the PETRA-led CÓDIGO research project (Spanish Ministry of Science and Innovation research grant FFI2010-15724). The application reformulates results on a single scale of difficulty from 1 (easiest) to 20 (most difficult). E.g., T2 has a difficulty score of 5 in sentence length in full words and a difficulty score of 6 in verbs per sentence. These figures should not be confused with absolute counts of verbs and full words per sentence. All parameters were back-engineered in the CÓDIGO project to allow for maximal ease of use. The application is still a beta, but has been tested through reading and comprehension tests on subjects that were either translation trainees or professional translators with more than 300 texts and satisfactorily contrasted with results of popular readability indexes.

		T1	T2	T3	T4
GENERAL	*Length in words*	*493*	*421*	*268*	*910*
	Length in paragraphs	*9*	*11*	*6*	*37*
	Average frequency of frequent full words (1–10k)	*131*	*159*	*141*	*177*
	Average frequency of single full words (1–10k)	*122*	*144*	*151*	*143*
LEXICON	Percentage of unrecognized words	4	8	8	9
	Average frequency of repeated full words (>3)	3	4	4	3
	Percentage of abstract words	1	1	1	1
	Percentage of cognates	11	5	10	4
	Percentage of false friends	1	1	3	1
	Percentage of nouns minus percentage of verbs	6	5	8	3
SYNTAX	Lexical density	9	5	6	7
	Within sentence cohesion	6	5	5	3
	Between sentence cohesion	5	7	3	2
	Verbs per sentence	7	6	4	4
	Sentence length in full words	9	5	6	3
	Clauses per sentence	8	8	5	4
	Percentage of modifiers	2	9	10	4
TEXTUALITY	Type token ratio	2	5	5	5
	Text cohesion	6	8	6	4
	Density of quantification	2	1	3	1
	Propositional density (per 100 words)	6	5	4	5
	Negated verbs	4	6	2	2
	Percentage of vague words	7	3	9	5

Table 1. Text profile of source texts. Sections other than general display difficulty on a scale 0–20, where 0 is the easiest

The data collection sessions of T1–T4 extended throughout October and November 2015. Full sessions, including regular classroom events and briefing, usually comprised one hour, except for the literary text (T4), which lasted two. That is, in each session some minutes would be devoted to preparing and closing the task. Students were free to translate at their own pace except in the case of the 493 word-long news text (T1), which was timed and therefore was translated against the clock – an exercise they would perform once a week, although the sample is from their second week after initial Inputlog training. The wide variety in texts, subjects and administration was intentional in an exploratory study aiming to dive into translators' cognitive processes beyond problem solving, and below the prevalent 3-second pause.

3.2. Pauses

Keylogging transcripts were analyzed with inbuilt Inputlog tools (Leijten/Van Waes 2013) at set pause thresholds. First, we needed to establish a baseline length for any timespan to be considered a pause. Then we had to set relevant higher thresholds for pauses that we would consider relevant and meaningful for different purposes. Let us see why and how.

Apart from obvious factors like typing skills and keyboard size and layout, Weingarten et al. (2004) review evidence showing that keystroke timing may be affected by up to three preceding keystrokes and the one following it. They also show that interkey time may be sensitive to (a) aspects such as whether two keys in a row are typed with the same hand or finger; and to (b) linguistic aspects, such as letter and word frequency; length, syllable and prefix boundaries, and the like. Immonen/Mäkisalo (2010: 58) found mode values for pauses between characters when translating to be of 100 ms; between syllables, of 140 ms; and between constituents of compound words, 180 ms.

Minimal actions, such as moving a cursor and pressing a button take their toll, and people seem to be sensitive to these costs. Gray/Boehm-Davis (2000) review experiments showing that changing information gathering from an eye movement to a mouse movement influences the decision-making strategies. They also found that increasing the cost of information acquisition from a simple saccade to a head movement may lead to using working memory, thereby increasing mental load. Furthermore, enlarging the number of necessary keystrokes to perform an action may induce a change from reaction-based behavior to a more planned behavior. Hence, people combine these minimal actions into behavioral micro strategies to optimize results while minimizing effort. That is, typing performance, monitoring and control may lead to actions that affect more than one keystroke and the associated pauses may be larger than the typical inter keystroke gap. In view of these notions, we chose to consider regular within-word pauses to be (possibly) mainly **mechanical** and too short to be of interest *at this stage*. Thus, we decided to raise the minimal threshold to single out *cognitive* pauses (Schilperoord 1996: 9), i.e., those that might be part of any translation processes, regardless of the input device.

Thus, we finally settled for a baseline pause of 200 milliseconds because

(1) typists take about 200 ms to stop typing once they decide to do so (Logan 1982);
(2) conscious episodes within cognitive cycles of recurring brain events usually start 200–280 ms after stimulus onset (Madl et al. 2011);
(3) earliest activations of lexico-semantic information first occur around 200 ms (Pulvermüller 2001).

Schilperoord (1996: 9) also suggests that oral production pauses shorter than 250 ms, or ‘physical pauses’ would be negligible. As a matter of principle, we should be interested in trying to keep the analytical apparatus for translation and interpreting as parallel as possible. On the other hand, and in view of our data, the large number of typos and repairs related to typing mistakes (up to 51.5%; Tirkkonen-Condit et al. 2008: 4), which usually take very short periods to fix, are probably relevant to our analysis, in that they may have an impact on, and from, mental load and other aspects of cognitive processes when translating.

On the other hand, Dragsted (2005), in translation, and Rosenqvist (2015), in writing research, note that applying a single pause criterion for all participants will conceal differences between them. Dragsted describes a complex method to calculate individual pause thresholds, but Rosenqvist suggests a much simpler procedure based on statistical analysis. Rosenqvist (2015) reverse-engineered a threshold through statistical means to capture writing bursts, and then he arbitrarily reduced it to twice the value of the median pause between words to better capture cognitive phenomena potentially associated with writing tasks. Interestingly, Rosenqvist also set a lower threshold to consider any minimal span of inactivity a (relevant) pause, which he established at 1.5 times the median pause within words.

In our analysis, (a) the minimal timespan, or baseline pause was 200 ms – that is, any and all shorter timespans were conceived of as *delays* and ignored. Then (b) Inputlog records were analyzed with such baseline pause. Afterwards, (c) boundary-setting pause thresholds, or upper thresholds, were computed that might correspond to activities such as reading, planning, and problem solving – pauses above these upper thresholds will here be called **long pauses (LPs)**. Finally, (d), in view of Gray/Boehm-Davis’ (2000) suggested notion of typing micro strategies, and following Schilperoord’s (1996) suggestion to discard ‘physical’ pauses, lower thresholds were also established above the baseline that were expected to mainly point to word and other sub-sentence phenomena potentially related to the translation process. Pauses between the upper and the lower thresholds will be called henceforth **mid pauses (MPs)**; those between the lower thresholds and the 200 ms baseline will be called **short pauses (SPs)**, although they (and **delays,** < 200 ms) will not be focused upon here because they are hypothesized to mainly reflect typing and other phenomena only vaguely related or unrelated to the translation task at hand.

In this exploratory study, we followed Rosenqvist in setting a lower threshold at 1.5 times the median pause within words, and arbitrarily raised the upper threshold to 3 times the median pause between words. Such modification was introduced following Immonen (2006: 333-4), who showed that pauses at levels lower than the sentence tend to be longer in translation than in monolingual writing, because that is where translation decisions such as word, grammatical choice, and clause formation are taken. In addition, Dragsted (2005) noted that people tend to translate in sets of two or three words that may be assumed to better correspond to phrase level and (monolingual) writing bursts. Lower and upper thresholds were established for each informant in each session, so the values are different in each case.

LPs were used to define **task segments** as anything between two LPs. This calls for a terminological note. In the expression *task segment, task* was favored, rather than *text* because it refers to recorded behavioral sequences where subjects mostly, but not always, produce a TT stretch apparently corresponding to a given ST chunk. Thus, text segmentation may refer to what subjects do on either or both STs and TTs. Often subjects will also break down their own pre-established ST or TT segments into smaller units or simply shift their boundaries, as evidenced in contiguous task segments. That is, text segmentation and production may become dynamically adapted to the subjects processing goals or needs. Furthermore, task segments can also be devoted to things other than writing, like information searches, and some of them do not even seem to serve any task-related particular purpose. *Segment* was preferred to *burst* because evidence was found of some unifying features within task segments – like uninterrupted action – but now and then also other features – e.g., information searches, corrections – linking several (mostly adjacent) task segments into what might be behavioral compounds of a higher order, which might perhaps be more properly considered bursts. For instance, several task segments may merge into a single problem-solving instance. Furthermore, *segment* seems quite a neutral term, when compared with, e.g., *step,* that would intuitively feel removed from task segments devoted to repairs of TT portions long gone, as pointed by Alves/Vale's (2009) concept of macro units.

All translation session records were chunked to determine whether the number of pauses and their length in milliseconds would yield differences to shed light on our research questions. Data was analyzed within task spans of 120 seconds because they were the largest ones that Inputlog would allow and we wanted to avoid excessive detail that might prevent us from seeing the broader picture. Results, however, are offered per minute when possible. **Task spans** should not be confused with **task segments,** although this entails no terminological claim. It should just be clear that 120 seconds task spans are an arbitrary way to divide the task into equal chunks in order to compare what happens within them, whereas task segments are those task stretches between two LPs which could be associated with different cognitive processing tasks and routines.

4. Results and discussion

4.1. Pauses

Table 2 shows the median values for pauses within and between words, which were used to calculate thresholds between short and medium, and between medium and long pauses. It also displays the number and percentage (in number and in milliseconds) of SPs, MPs and LPs.

txt	sub	mWw ms	mBw ms	SP #	SP % #	SP %ms	LT	MP #	MP % #	MP %ms	UT	LP #	LP % #	LP %ms
T1	A	270	700	**1284**	*50.0*	*23.6*	405	**1103**	*42.9*	*40.0*	2100	**183**	*7.1*	*36.4*
	G	230	470	**1189**	*50.1*	*23.7*	345	**914**	*38.5*	*36.2*	1410	**268**	*11.3*	*40.1*
	M	300	530	**904**	*46.0*	*22.2*	450	**800**	*40.7*	*33.0*	1590	**263**	*13.4*	*44.8*
	R	270	420	**999**	*48.3*	*21.6*	405	**721**	*34.8*	*32.3*	1260	**350**	*16.9*	*46.1*
T2	A	270	730	**836**	*49.2*	*12.0*	405	**715**	*42.1*	*32.7*	2190	**148**	*8.7*	*55.4*
	G	230	450	**848**	*47.1*	*20.6*	345	**704**	*39.1*	*32.8*	1350	**249**	*13.8*	*46.6*
	M	300	510	**624**	*43.0*	*19.7*	450	**592**	*40.8*	*30.9*	1530	**235**	*16.2*	*49.4*
	R	280	450	**681**	*46.4*	*20.1*	420	**532**	*36.2*	*29.0*	1350	**255**	*17.4*	*50.8*
T3	A	270	800	**696**	*47.1*	*21.1*	405	**663**	*44.9*	*39.9*	2400	**118**	*8.0*	*39.0*
	G	240	640	**417**	*42.6*	*18.2*	360	**439**	*44.8*	*37.0*	1920	**123**	*12.6*	*44.8*
	M	300	500	**651**	*46.5*	*24.1*	450	**579**	*41.4*	*35.6*	1500	**170**	*12.1*	*40.4*
	R	270	560	**774**	*47.7*	*24.2*	405	**696**	*42.9*	*41.5*	1680	**152**	*9.4*	*34.3*
T4	A	270	590	**1290**	*52.2*	*24.4*	405	**969**	*39.2*	*39.4*	1770	**214**	*8.7*	*36.2*
	G	230	420	**557**	*52.8*	*23.3*	345	**358**	*33.9*	*33.0*	1260	**140**	*13.3*	*43.7*
	M	270	480	**600**	*44.5*	*26.2*	405	**629**	*46.6*	*40.9*	1440	**120**	*8.9*	*32.9*
	R	250	410	**881**	*44.8*	*20.5*	375	**773**	*39.3*	*31.0*	1230	**311**	*15.8*	*48.6*

Table 2. Short, medium and long pause minimal lengths, number and percentages in T1–T4.
Legend: sub, subject: mWw, median pause within words; mBw, median pause between words; SP, short pauses; MP, mid pauses; LP, long pauses; LT, lower threshold value = mWw * 1.5; UT, upper threshold value = mBw * 3

In this study, and depending on the session, short pauses (SPs) lasted from 200 to 344–449 ms; their share of the total number of pauses ranged from 42.6% to 52.8%; in time, SPs took from 12% to 26.2%. The lower threshold (LT) was set at 345–450 ms and the upper threshold (UT), at 1230–2400 ms. Mid pauses (MPs) – those between thresholds, varied from 33.9% to 46.6% in number, and from 29% to 41.5% in time. Here, mid pauses (.35–2.4 seconds) roughly corresponded to 'shorter pauses' (.5–2 seconds) in Lacruz et al. (2012). The share of long pauses (LPs, those above the upper threshold) in number was 7.1–17.4%, and in time, 32.9–55.4%.

		SEGMENTS #	ST words	ST *char+spa*	TT words	TT *char+spa*
T1	A	**211**	2.34	*13.68*	2.49	*15.16*
	G	**296**	1.67	*9.75*	1.87	*11.13*
	M	**289**	1.71	*9.99*	1.91	*11.32*
	R	**377**	1.31	*7.66*	1.53	*9.11*
T2	A	**171**	1.85	*10.28*	1.94	*11.46*
	G	**272**	1.41	*7.75*	1.53	*8.63*
	M	**258**	1.63	*8.95*	1.72	*9.53*
	R	**278**	1.28	*7.06*	1.45	*8.37*
T3	A	**141**	1.06	*6.84*	1.23	*8.05*
	G	**140**	0.89	*5.84*	1.12	*6.88*
	M	**192**	1.11	*7.01*	1.28	*7.74*
	R	**174**	1.48	*9.45*	2.01	*12.36*
T4	A	**408**	1.82	*9.81*	1.81	*9.88*
	G	**412**	1.77	*9.52*	1.73	*9.49*
	M	**322**	2.83	*15.28*	2.87	*16.03*
	R	**589**	1.22	*6.60*	1.26	*6.96*

Table 3. LP-defined task segments and their average ST and TT length in words and characters+spaces

Inputlog computes production (writing) bursts as anything that happens between two pauses of a certain length. In our study, LP-defined task segments turned out to be slightly smaller than expected: the averages rarely comprised more than two words from the STs and the TTs (table 3). In other words, our arbitrary choice of an enlarged upper threshold of *median pause between words * 3* might be a little bit too low. Task segments are expressed both as ST and as TT magnitudes because it is the ST what translators chunk, the TT segment being a consequence of such chunking.

In spite of the above considerations, when empty task segments – those where no text was added, deleted or moved around, but where only cursor moves about the text were registered – were subtracted, the figures improved and neared the expected lengths. That is, once the data comprised only task segments with typing or changes in the text-written-so-far, average text lengths were nearly in line with those derived from the text segmentation proposed by Dragsted (2005). For example, when 31 task segments with no text additions or deletions (just movements about the ST and TT) were subtracted from T1-A, text in task segments averaged 2.74 ST words and 2.92 TT words (15.86 and 17.57 characters+spaces, respectively).

Short, mid and long pauses were posited to spring from different causes and could therefore be considered different variables. LPs may be associated (at least) with problem solving and SPs may be mainly associated to Gray/Boehm-Davis' (2000) behavioral micro strategies to maximize typing efficiency. This leaves mid pauses as indicators of cognitive processes that are neither related to typing nor associated with problem solving. Factors affecting one kind of pause should not necessarily affect the other kinds. Linear relationships between the three kinds of pauses in pairs were seeked because, if one of them changes when the other one does, and such changes are more or less proportional, those variables may be suspected to be associated, perhaps (partially) due to the same cause.

	SP-MP				SP-LP				MP-LP			
	A	**G**	**M**	**R**	**A**	**G**	**M**	**R**	**A**	**G**	**M**	**R**
T1	0.28	0.45	0.07	0.44	0.34	0.46	0.27	0.38	0.11	0.52	0.42	0.38
T2	0.72	0.49	0.22	0.27	0.57	0.28	0.54	0.42	0.54	0.17	0.38	0.47
T3	0.73	0.29	0.71	0.65	0.63	0.15	0.62	0.55	0.57	0.15	0.64	0.59
T4	0.42	0.48	0.38	0.28	0.26	0.30	0.31	0.35	0.33	0.46	0.54	0.39

Table 4A. Kendall rank correlation coefficient (tau) between the aggregated duration of short (SP), mid (MP) and long pauses (MP) within 120-second spans

Table 4A displays the values of Kendall's tau correlation analyses, showing weak relationships between the duration of (a) short and mid pauses, (b) short and long pauses, and (c) mid and long pauses. Only in three cases (in blue), the correlation is mildly significant, and the sign remained positive throughout the table.[8] In brief, the length of the initial LP – that might be associated with having identified a problem, or even with the difficulty of such problem – seemed to have scarce impact on the duration of the mid pauses within the task segment that followed.

Since Lacruz et al. (2012) showed that translation problems might impact the number of pauses, rather than their length, the numbers of LPs were also checked to determine whether they had a significant correlation with the numbers of MPs within 120-second spans. Table 4B displays the values of Kendall's tau correlation analyses between the numbers of (a) short and mid pauses, (b) short and long pauses, and (c) mid and long pauses in 120-second task spans in each log file. This time correlations were even weaker and the sign was not always positive. The number of pauses associated to major cognitive processing with no recorded activities, such as those devoted to translation problems (LPs) within a task segment did not seem to correlate with the number of mid pauses. Still, the correlations between SPs and MPs are higher and always positive.[9] Taken

8 The scarce sample and the differences in subjects, text types and contents, and administration conditions led us to choose 0.70–0.79 as values indicating moderately significant correlations, 0.80–0.89 as indicators of good correlations, and 0.90 and above as strong correlations throughout the study.

9 We also checked whether the duration of LPs correlated with the number of MPs across all texts and obtained a tau coefficient of -0.27.

together, these data led us to think that MPs might be related to cognitive phenomena other than those associated to LPs.

	SP-MP				SP-LP				MP-LP			
	A	**G**	**M**	**R**	**A**	**G**	**M**	**R**	**A**	**G**	**M**	**R**
T1	0.44	0.48	0.21	0.25	0.14	-0.12	0.24	0.24	-0.13	-0.27	0.11	0.07
T2	0.58	0.49	0.35	0.49	0.14	-0.18	0.28	0.30	0.27	0.04	0.10	0.30
T3	0.38	0.47	0.42	0.28	0.05	0.24	-0.01	0.16	0.05	0.24	-0.08	-0.05
T4	0.52	0.46	0.44	0.41	0.01	0.04	0.23	0.32	0.07	-0.03	0.00	0.10

Table 4B. Kendall rank correlation coefficient (tau) between the number short (SP), mid (MP) and long pauses (MP) within 120” spans

There is still the possibility that MPs were natural resting breaks derived from the typing activity. In this case, the number or duration of MPs might be related to the number of logged events, i.e., the number of keystrokes and mouse movements and clicks as recorded by Inputlog. Table 4C summarizes the analysis of the correlations between the number of events per 120-second task spans, and the number and duration of MPs in each of such spans. Only two log files yielded a moderately significant positive correlation between the aggregated duration of MPs and the number of logged events in 120-second task spans. All in all, the combined results reported in tables 4A, 4B and 4C might mean that some typing microstrategies surpassed the posited lower threshold and thus that it might be appropriate to raise it in order to better distinguish between typing micro strategies and other translation-inherent phenomena. This will be one of our next research goals.

	MP number				MP duration			
	A	**G**	**M**	**R**	**A**	**G**	**M**	**R**
T1	0.57	0.42	0.21	0.14	0.28	0.15	-0.03	-0.03
T2	0.16	0.04	-0.31	0.09	0.50	0.49	0.22	0.27
T3	0.13	0.47	0.06	0.15	0.73	0.29	0.71	0.65
T4	0.21	0.11	0.30	0.10	0.42	0.48	0.38	0.28

Table 4C. Kendall rank correlation coefficient (tau) between the number of logged events and the number of mid pauses or the aggregated duration of mid pauses within 120-second spans

In any case, even if MPs are not part of uneventful processing nor of problem solving, will they yield relevant information? Let us consider several examples of particularly long task segments from the transcript of the session where Ana translated T1 against the clock.[10] Immonen (2006: 326; 2011: 246) notes that translating differs from monolingual writing in that more pauses are found at lower level unit (words and clauses) than upper level (sentences and paragraphs) boundaries. This is indeed the case in our sample, as shown in Ana’s transcript of the T1 session (available upon request), where only 4 out of 26 sentence ends are marked with an LP, the rest being flanked by an MP, often two at both sides of the period. This supports Immonen’s analysis but our

10 Conventions for keylogging transcript notation: task segments are separated with horizontal lines (LP length in seconds at left margin, in dark blue). MPs are represented as light blue diamonds (◆), where each diamond equals 200 ms, starting from the length of the lower threshold. In Ana’s T1, the UT is 2100 ms and the LT, 405 ms. Space bar is represented with a purple underscore or low line symbol. Mouse clicks are represented in orange with the symbol ¤. In these examples, all clicks are left clicks. Shift keys (for uppercase) are represented with an s between purple bars, |s|. In these examples, they are all right shift keys. Grey keys represent movements about the text, mainly with the cursor (m) or scrolling (#). Deletions with the back key are coded with «. Text in green was typed in web browsers and it is not part of the TT.

data also take it a little further: None of the eight paragraph boundaries – between unrelated pieces of news – were separated by an LP, as in example 1 (greyed stretch).

1 [...] isolation over the partial annexation of Ukraine.
Catalan nationalists [...]

3.8s ·m·¤·m2·¤·m2·◆◆◆isolation¶·m#m#m·◆◆◆◆·#·m·¤·m2·¤·m·¤·◆◆◆◆◆_◆◆por_◆la◆◆◆_
◆◆◆ a◆ne◆◆c◆◆◆«xi|'|on_parcial_de_|s|Ucrania◆◆◆◆.◆◆◆¶◆·m·¤·m·◆·#·
◆◆◆◆◆·m·¤·m·◆|s|La◆«os_◆◆nacionalistas_◆|s|catalan◆e◆◆◆s◆◆·m·¤·m·◆◆◆◆◆◆«◆◆|s|

2 [...] Mr Chan’s supporters say that the university buckled [...]

2.3s |s|◆◆◆|s|Los_partidarios_de_|s|Chan◆◆·m·¤·m2·◆◆si◆◆◆◆«upport◆◆◆◆er¶·m#m·¤m2·¤m2·
◆◆◆_◆◆◆◆dic◆◆e◆«3◆◆◆«◆◆afirman◆◆_q◆◆◆◆ue_la_universidad◆◆◆◆_◆◆·m·¤·m·
◆bluck◆◆¶·m·¤·◆◆◆◆◆ed

2.2s ·m·◆·m·¤·◆◆«6◆◆u◆◆c◆◆k◆◆le◆¶·m#·◆◆◆◆◆·m#·.·m¤2·m2·¤·m2·«¤·m·

Information search is typically considered an indicator of problem solving because translators might be or feel unable to proceed until they add newly acquired information to that already active in their memories. In the T1 session, Ana sought information in the Internet 18 times, but only 8 were preceded by an LP, as in example 1 (green text). In fact, in two of these eight instances, LPs seemed to be motivated by typos. In example 2 (greyed), Ana read *buckled* and typed *bluck* in the browser. After looking at the results she entered *-ed (=buckled)* but then she either noticed she had made a typo right away or did not find satisfactory results and perhaps thought about them or checked the ST word again, only to notice that the word was misspelt. In a new task segment, she deleted the whole word up to the typo and this time entered it correctly. By solely focusing on LPs we would have missed a lot of information, even related to problem-solving subtasks, such as planning, reading and re-reading, and information seeking.

Ana’s T1 transcript also yields information on monitoring activities not linked to problem solving. Lorenzo (1999: 26) suggested that translators will not press the space bar – usually, at the end of a translation unit – until they think that they are done with that unit. Indeed, this is exactly what happens in at least eight points of Ana’s T1 transcript: even LPs may separate the text-written-thus-far from the following space bar, as in example 3 (second task segment, after the second *Homs*):

3 [...] used them for the first time, striking targets near Homs [...]

6.6" primera_vez◆◆◆◆◆,_◆◆·m·¤m2·¤·◆|s|Homs¶·m·¤·m·striking¶·m#m·◆·#·◆◆◆·m¤2·m2·¤·m·
◆◆◆◆¤◆golpeando_los_◆◆objetivos◆_cerca_de◆◆◆◆◆_|s|Homs

6.7" _

A few pauses between word-final letters and a space bar interval are LPs but in many more instances (18) they are MPs, as in example 4 (highlighted in grey, first line). This supports Lorenzo’s observations, and the higher occurrence of MPs in these circumstances suggests that they might be better indicators of monitoring than LPs are. Furthermore, the fact that many of these MPs do not fall at the end of a phrase or segment hints at a more general behavior of pressing the space bar only after the relevant portion of the text-written-thus-far has been monitored and approved. In some cases – especially when MPs fall within, rather than at, phrase boundaries – we may not be dealing with problem solving or “mechanical” typing matters. They might rather flag production sidelines, activities from a subtask other than the main one in the task segment – such as fixing typos and other small repairs, searching for mainly lexical information and the like – that the subject will resume with no LP to discriminate between sub tasks (e.g., example 4, second line).

4 [...] which recently stunned the West by deploying [...]

2.8" que◆◆◆_◆◆recientemente◆◆_◆◆ha_sorpre◆◆◆ndido◆◆◆_◆◆◆a_◆◆◆◆|s|O◆◆«

◆·m·◆◆|s|Occidente◆·m·¤·m#m·¤·m·◆◆·m¤2·m·◆deplo◆◆◆y¶·m#m·¤m2·¤·m2·◆◆◆◆_◆◆◆

◆desplegando

Thus far, enlarging the analysis of the process to MPs seems to confirm but also to suggest some modifications to conclusions reached through the study of LPs. Are there additional phenomena to be captured by studying MPs? Uncertainty might be one of them. In example 5, Ana stops twice, possibly to rethink how to render the phrase "of the government". However, once she has solved it, she comes back to (prior and incorrectly rendered) *oponentes* and changes it to correct *opositores* (greyed). Could the slow and decreasing typing speed in original *oponentes* be a potential indicator that Ana was not very happy with her first rendering of *opponents*?

5 [...] , though opponents of the government say this [...]

2.1" ,◆◆_◆◆aunque_◆◆los_◆op◆on◆en◆t◆◆◆◆es_a◆◆◆◆◆«

2.7" de◆◆«◆◆◆◆«

3.3" del◆◆◆◆◆_gobierno◆◆_◆◆dci◆◆«2icen◆◆◆◆_q◆◆·m·¤·m·◆◆«6◆◆sitor◆es◆◆|s|◆·m·¤

◆◆◆◆◆ue◆◆◆◆◆_

In example 6, Ana also hesitates between two renderings for *fighter jets* and types them, only to delete one afterwards. Several MPs within and after both words signal her monitoring of the candidate solutions:

6 [...] fighter jets to Syria, [...]

2.3" ·m·¤m2·¤·m·◆◆aviones_de_com◆◆bate◆◆◆◆|s|/guerra◆◆◆◆_◆e◆n◆◆◆◆_|s|Siria

◆◆◆,◆_◆◆·m·¤·m·◆«2◆◆«4◆◆«◆◆◆◆◆·m·¤m2·¤m2·¤·m·

In any case, many MPs – especially when distributed throughout the text of a task segment, irrespective of word and clause boundaries – might be motivated either by high mental loads (e.g., examples 4, 5, 7), as suggested by Lacruz et al. (2012), or by shifts of attention to ST special features, such as figures (as in examples 7 and 8). In fact, many typos might be associated with such higher mental loads as hinted at by scattered MP patterns. In examples 7 and 9, four out of five typos (underlined) were due to pressing a neighboring key in a standard Spanish qwerty keyboard, probably a hint at a drop in the monitoring and control of the typing activity – a likely indicator that attention shifted and was focused elsewhere.

7 [...] high earners from 40% to 25%, even lower [...]

2.2" asalari◆◆◆◆ados◆◆_de◆◆l_◆◆◆40◆◆◆_al_◆◆25◆◆◆◆|s|&◆◆◆◆◆«_|s|%◆◆,_incluso◆◆◆◆

◆◆mejo◆◆◆«3◆◆enos◆◆◆◆◆

8 [...] in the regional parliament based on a vote of 48%. [...]

7.6" en_el_◆parlamento_re◆gional◆_◆con_◆◆un◆◆◆◆◆_◆◆◆48◆|s|◆◆%◆◆◆_◆◆◆◆◆de_los

_votos

9 [...] His critics say he is trying to position himself as a key player [...]

3.1" s_c◆r|'|iticas_incluyen◆◆_que◆◆◆_◆est◆|'|a_◆inten◆◆◆◆tando◆◆◆◆◆_

4.3" po◆◆◆◆◆s◆◆◆◆i◆◆cinarse_◆◆◆«6◆◆o◆◆◆◆narse◆◆_como_un◆◆◆◆_◆◆kugador

_c«9◆◆jugador_cñav«3◆◆◆◆◆lave

4.2. Rhythm

Pauses are often used to plot cognitive rhythm when translating. For instance, examples 1–9 in the previous section portrayed the translation process as a vertical sequence of task segments separated by LPs. There are other possible factors to outline translators' cognitive rhythms, such as the number and length of task segments (both in characters and in milliseconds) in preselected process time spans. Before we analyze typing speed, let us consider task segments, rather than their boundaries (figure 1).

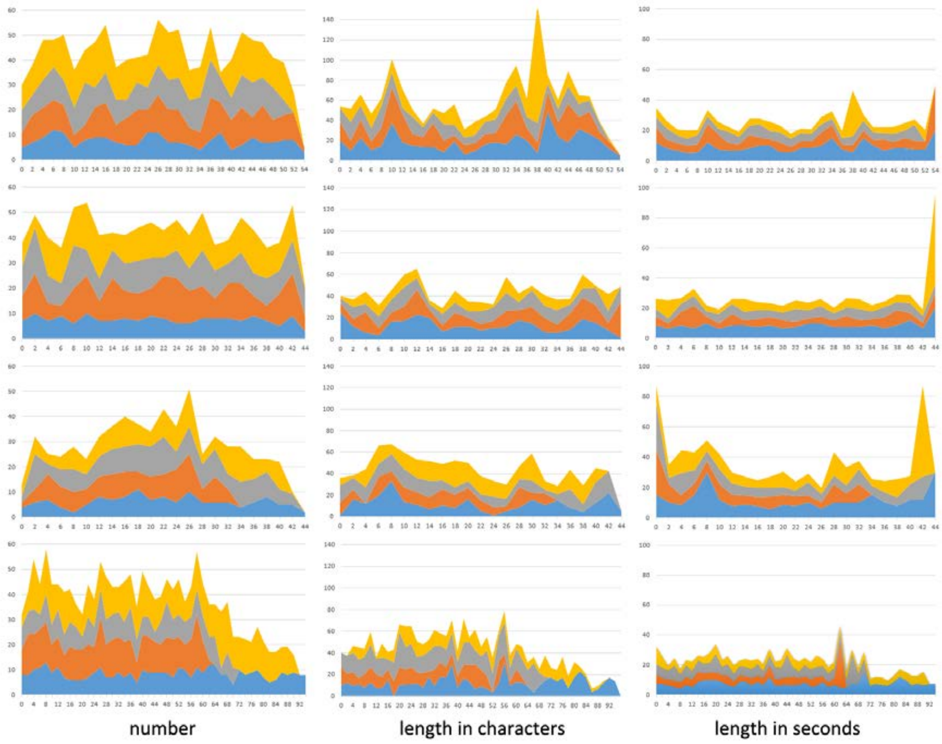

Figure 1. Task segment number and length in characters and in seconds of comprised TT segments (Y-axis) in minutes (X-axis), in T1–T4, from top to bottom

Subjects: Ana, blue; Gaspar, orange; Marco, grey; Rosa, yellow

Figure 1 shows stacked line graphs to visualize overall trends over time. There is a possible tendency for the number of segments to grow in the first 5–10 minutes, while they become shorter in time and longer in characters. This could be interpreted as an indicator of progressive ease in the task that might be explained by contextualization, i.e., progress in an initial, orientational phase. There also might be a tendency in all parameters to decrease transitorily ca. 20 minutes from the start (dips that tend to fall between minutes 18–22). This might be the consequence of sustained attention decay. Data do not support that task segments toward the end of sessions will comprise more characters, although they seem to last longer, probably a hint of revision activities. Only Marco finished the assignment in T4 (short story), and this is probably the reason why there are no long segments by the end of this text. Of course, with four subjects and four texts, all this is only a matter of sheer speculation, a hint that the topic deserves further research. In any case, what really stands out from the data is that there are no apparent switches between two modes, but rather a continuous, irregular, jagged progression where subjects seem to tend to display relatively parallel behaviors in their interaction with the texts. Let us now turn to typing speed.

Figures 2-5 display variations of typing speed (keystrokes per minute) for all 16 sessions, where the X-axes display task progression in minutes and the Y-axes, the number of keystrokes. The blue lines display absolute or raw typing speeds and show relatively moderate but constant oscillations. However, pauses are technically nothing else than periods when no activity is recorded, where subjects are assumed to be doing anything but typing. Thus, computing long pauses, those considered to be thresholds between task segments of recorded activity (basically, keyboard and mouse usage), may be wrong since per definition they happen when typing has been intentionally interrupted to devote time and resources to something else. Once long pauses were subtracted and the typing speeds accordingly recalculated, differences often became more important and somewhat more dramatic saw tooth lines became evident (orange lines).

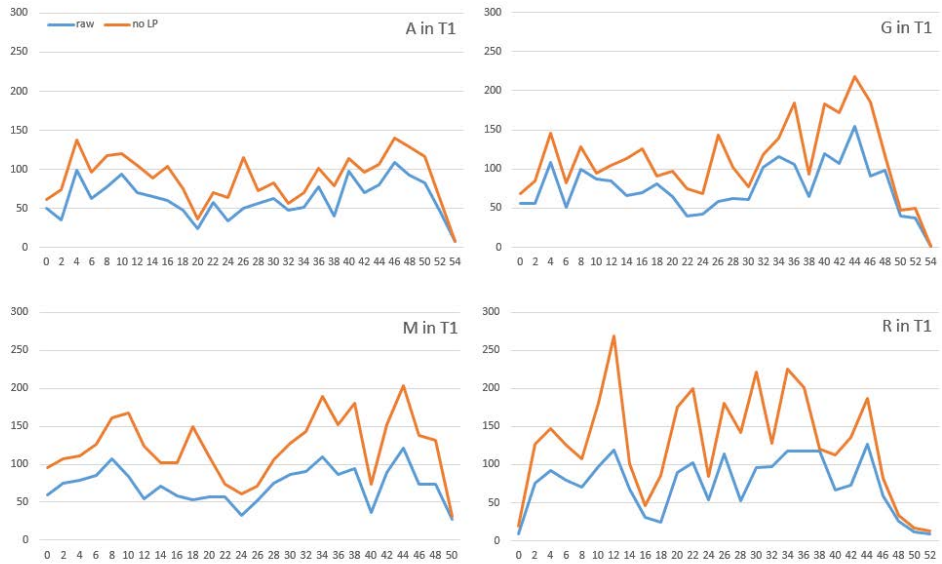

Figure 2. Typing speed variations in the timed translation (T1, news) for Ana (A), Gaspar (G), Marco (M) and Rosa (R)
X – minutes; Y – keystrokes; blue line – raw speed; orange line – speed with no LPs

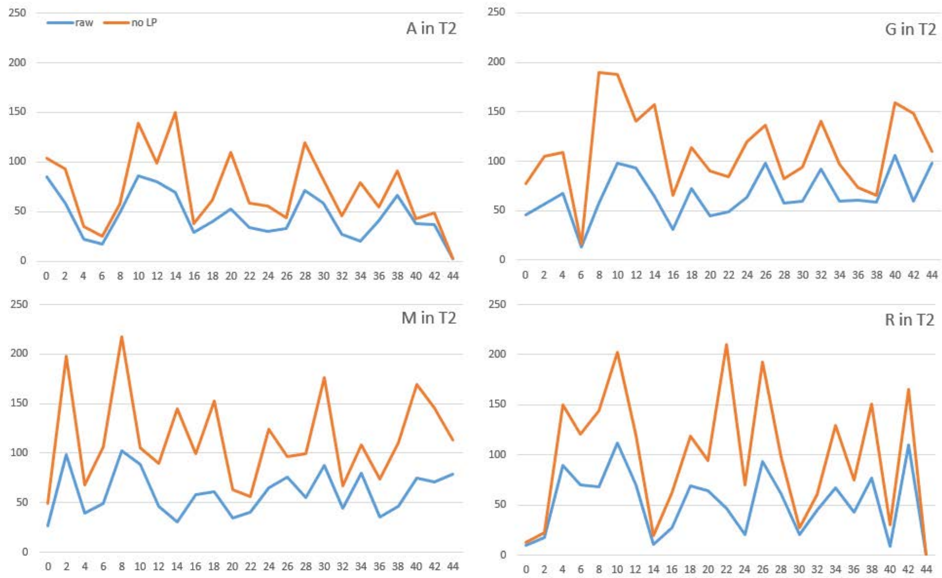

Figure 3. Typing speed variations for Ana, Gaspar, Marco and Rosa in T2 (speech)
X – minutes; Y – keystrokes; blue line – raw speed; orange line – speed with no LPs

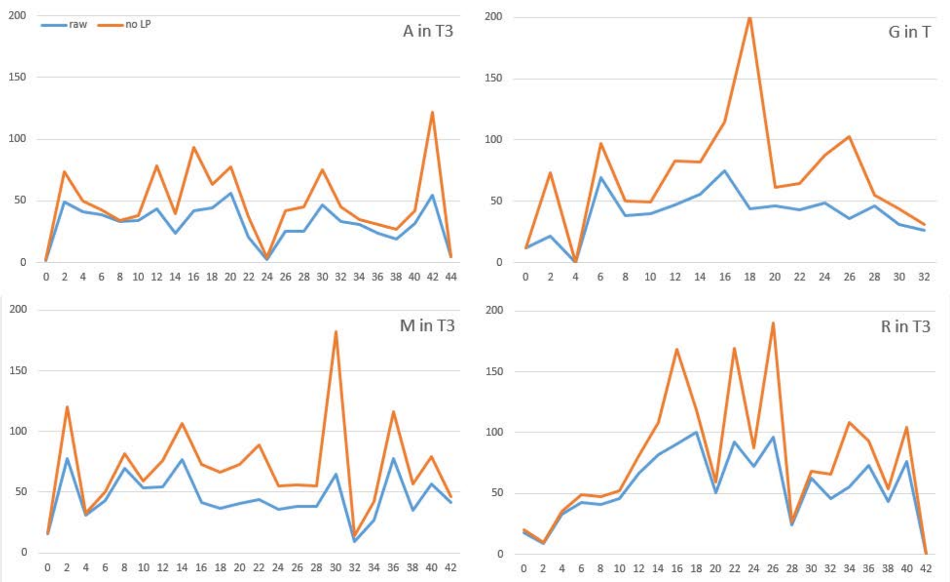

Figure 4. Typing speed variations for Ana, Gaspar, Marco and Rosa in T3 (tourist guide)
X – minutes; Y – keystrokes; blue line – raw speed; orange line – speed with no LPs

Figure 5. Typing speed variations for Ana, Gaspar, Marco and Rosa in T4 (fiction)
X – minutes; Y – keystrokes; blue line – raw speed; orange line – speed with no LPs

This succession of peaks and dips might point to translation really proceeding in bursts, action sequences longer than LP-defined task segments that would consist of contiguous sequences of such task segments. There seems to be a tendency to have a dip between minutes 4 and 8, often flanked by peaks. These early peaks and dip might be interpreted as potential indicators of contextualization and warming up to the task, i.e., as part of the initial orientational phase. A second, often lower dip tends to fall around 20 minutes from onset, and a third one seems to tend to fall 38–42 minutes from start. This tends to happen in the four informants and in the four texts, although variation within and between more subjects might prove to be higher.

One of the observations of De Rooze (2003) was that the individual behaviors within the informant group of advanced translation trainees were closer to each other than that of novices and professionals, probably due to some years of exposure to similar influences and training practices. When the full data set is considered, the influence of text phenomena may probably be ruled out as possible explanation, due to the wide differences between the texts (see text descriptions in section 2.1). Again, this should only be interpreted as a strong suggestion that the matter deserves further research. What really stands out in figures 2-5 is the constant fluctuation in typing speeds irrespective of long pauses. Such fluctuations in typing speeds were quite independent of the number of pauses customarily associated with problem solving (LPs). Interestingly, they were also independent of other cognitive activities such as uncertainty management and monitoring that might be more associated with MPs. Table 5 shows that Pearson positive correlations between typing speeds and the number of LPs tend to be stronger in Rosa (R), the only touch typist. In contrast, Ana, the worst typist, shows stronger associations between her typing speeds and SPs, i.e., those pauses defined here as mechanical.

	SP				MP				LP			
	A	G	M	R	A	G	M	R	A	G	M	R
T1	**0.81**	0.63	0.54	-0.11	0.54	0.42	0.00	0.12	0.36	0.45	0.49	0.11
T2	0.41	0.31	0.41	0.42	0.27	0.06	-0.08	0.38	0.14	0.54	0.62	0.68
T3	0.71	0.09	0.34	0.55	0.34	0.37	0.45	0.35	0.33	0.27	0.58	**0.82**
T4	0.76	0.45	0.58	0.64	0.61	0.42	0.26	0.36	0.30	0.31	0.52	0.57

Table 5. Pearson's correlation analysis between typing speed and the number of short, mid, and long pauses, per minute

5. Conclusions

We set out to test whether pause thresholds lower than 3 seconds would point to systematic behavioral phenomena that could be reasonably associated with cognitive processes other than problem solving (question 1) and whether other recorded regularities of behavioral phenomena would pin down progressions of any kind throughout the translation tasks (question 2). We set a baseline threshold of 200 ms for any timespan to be considered a pause and, following and adapting Rosenqvist (2015) to translation, we set a lower threshold of 1.5*median *within* word pause and an upper threshold of 3*median *between* word pause. Such thresholds classified pauses into three kinds: short pauses, possibly associated to typing micro strategies; long pauses, customarily linked to problem-solving activities; and pauses between thresholds, or mid pauses, that comprised at least 1/4 of the total number of pauses in each session and about 1/3 of their respective total pause times.

Short and mid pauses were only weakly correlated in number and length with long pauses, pointing to different behaviors and perhaps hinting at different cognitive processes. The suggested temporal lower thresholds might benefit from fine-tuning, because short and mid pauses tended to be moderately associated. In any case, the upper thresholds split the texts into task segments comprising TT segments quite close to Dragsted's (2005) suggested length for translation units, and mid pauses were quite close in length to Lacruz et al.'s (2012) shorter pauses. Examples from the analysis of one transcript showed that mid pauses might be better indicators of paragraph and sentence boundaries, and even of information seeking, although the session was timed and this might have influenced the behavior of the translator. Mid pauses were especially sharp at pointing to monitoring strategies unrelated to problem solving, such as uncertainty and high mental loads. Overall, our first question found a provisional answer. It seems that establishing a high upper pause threshold to single out problem solving may in the end be questionable, because it does not filter appropriately translation problems in and different cognitive processes out, and because it does not help improve current ways of isolating subtasks such as information seeking, and identifying phenomena like uncertainty. On the other hand, setting lower and upper thresholds as potential indicators of cognitive activities seems to be a promising path to apprehend such phenomena and other task-related cognitive activities, such as monitoring, and evaluating.

Further analyses of the frequency of task segments and their length in characters and in milliseconds, and of typing speed showed that they all tend to be unrelated to problem solving but also to other cognitive activities, such as monitoring. The data pointed to the possible existence of task segments within cycles of 4–8 minutes, which might be successive periods of selective attention, and performance decays in spans of some 20 minutes. An orientational period, possibly combining contextualization with warming up to the task, lasted the first 4 to 10 minutes.

Four texts by four subjects are definitely too small a sample to believe that these findings can be generalized in any way, but it may only take one instance or one subject to prove or disprove some tenets. The analysis shows an uneven continuum of intermittent, alternating subtasks, rather than a binary automaton switching between two processing modes. These variations cannot be explained by the Monitor Model as it is. Mental activities seem to be far more varied and recurrent than a binary model, let alone an unchanging automaton, can handle. In other words, we found no support for the Monitor Model. As customary, the strongest conclusion from this exploratory project is the need for further research. Indeed, the chunking of the process into task segments, cycles (or bursts), and longer periods of sustained attention deserves more study. Changing the approach towards studying translation behavior in longer tasks, focusing on all pauses above a given lower threshold, and on the contents of task segments defined by an upper threshold, adding features such as typing speed, might be one way to do so.

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