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Reconceptualizing breaks in translation: Breaking down or breaking through?

Erik Angelone
Kent State University, United States
eangelon@kent.edu

Álvaro Marín García,
Universidad de Valladolid, Spain
alvaro.marin.garcia@uva.es

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Abstract: Various observable on-screen translator behaviors, such as extended pauses in activity, mouse hovering, cycling through tabs/windows, and different kinds of scrolling, all common occurrences during task completion, have been regarded as potential problem indicators (cf. Angelone, 2018). Their presence is often attributed to a breakdown in declarative and/or procedural knowledge at a concrete problem nexus (Angelone and Shreve, 2011). Inspired by recent translation process research on aspects of cognitive ergonomics, pause-related cognitive rhythms (Muñoz and Cardona, 2018), and Kussmaul's notion of *parallel activity* in the translation process (1995), we re-examine such phenomena through a different lens. We propose these phenomena may represent the loci of volitional, potentially strategic breaks rather than problem indicators per se. That is, the breaks observed are not necessarily linked to specific problems, but rather to subjects' cognitive resource management. Our findings suggest that apparently random behaviors, seemingly unrelated to the task, generally have a positive impact on performance from both process and product perspectives. We refer to these breaks as instances of *cognitive suspension*, and, based on our findings, propose that translators engage in them as a refresh mechanism when performance has either waned or runs the risk of doing so. We start by examining cognitive suspension in terms of types and scope. This is followed by an empirical analysis of its direct impact on translation performance, as established by number of errors, number of generated characters, and number of typos within established windows (areas of interest) that precede and follow its occurrence.

Keywords: Translation process research; cognitive suspension; parallel activity; cognitive translation studies

1. Introduction

1.1. Pauses and breaks in the translation process

Pauses have long been at the center of Cognitive Translation Studies (CTS) as behavioral indicators of problem-detection and corresponding problem-solving processes (see Kumpulainen, 2015), with keystroke logging generally being the method of choice for exploration, and the pauses analyzed being relatively short in duration. In broad terms, pauses have been found to occur in conjunction with such phenomena as reading source content, retrieval of information from internal or external support, or carefully reviewing generated content in the target text in relation to the corresponding source text, among many others. To date, CTS scholars have often studied and documented pauses on the understanding that they are motivated by a breakdown in the translator's declarative and/or procedural knowledge at a concrete problem nexus (Angelone and Shreve, 2011, p. 109). Thus, the assumption follows that any processing immediately leading up to the behavioral pause, in other words, the location where the problem is encountered, is relatively un-problematic, uneventful processing, while the behavior immediately following a pause is the result of strategic, active, and conscious problem-solving. Tirkkonen-Condit's Monitor Model (2005) is perhaps the most well-known and influential example of the theoretical modelling of this assumption, substantially developed most recently by Schäffer and Carl (2015) in moving away from what was previously thought to be a primarily linear problem-solving sequence.

Inspired by the tenets of Cognitive Translatology and recent research on cognitive ergonomics in translation (Muñoz, 2010; Risku and Windhager, 2013; Ehrensberger-Dow, 2015; Ehrensberger-Dow and Jääskeläinen, 2018), we propose reconceptualizing translation pauses and their related parallel activities not necessarily as behavioral indicators of cognitive deficits at the intersection of the task and the subjects' competence (Hurtado Albir, 2017), but rather as breaks or, as we call them, instances of *cognitive suspension*. This suspension entails a secondary, inconsistent, and seemingly distracting activity (extended on-screen macro-pauses of ten or more seconds, random mouse hovering and scrolling, and seemingly groundless cycling through tabs/windows) that ultimately leads to improved performance. In providing a theoretical foundation for these underexplored phenomena, we go back to Kussmaul's construct of the parallel-activity technique (1995) and revisit it in light of recent contributions to our understanding of the translating mind.

1.2. The parallel-activity technique

In his empirical work on the pedagogy of translation, Kussmaul (1995) found that when translation trainees were blocked or when they encountered an apparently unsolvable problem, they would take a break from the translation task and engage in any other brief activity that would free their minds from the problem at hand. This break would ideally lead to an epiphany or the sudden finding of a solution:

> It could be observed in the protocols, and it is also a common experience, that when trying hard to find a solution to a problem, our minds are sometimes blocked, and "illumination" is thus impeded. We all know the situation when we try in vain to recall a person's name and after a short time, during which we have been engaged with some other task, we all of a sudden remember it. This technique of leaving one's mind alone for a while and thus creating the necessary relaxation, which I propose to call parallel-activity technique was also made use of by the students I observed. (p. 43)

Kussmaul was thus documenting a cognitive phenomenon that, as he himself noted, is very common and one that anyone translating or engaging in any other cognitive activity has experienced and intuitively described. Moreover, he was the first translation studies scholar to model the technique and describe it using a construct, which, until now, has not received all the attention it merits.

The *parallel-activity technique* derives from psychology and evidences Kussmaul's familiarity with the work of J. P. Guilford (1975) and his interest in the study of creativity in translation (1991). Kussmaul described parallel-activity techniques as ways to overcome mental blocks by relaxing, thus allowing an 'illumination,' which is one of the four stages of creativity in Wallas' classic model of creativity (1926). Based on the self-reporting of French mathematician Henri Poincaré's work on Fuchsian functions, this model describes creativity as a problem-solving process including a) *preparation*, where the problem is analyzed; b) *incubation*, during which there is no conscious processing of the problem; c) *illumination*, marked by the sudden appearance of the epiphany or solution; and d) *verification*, during which the subject switches back to a conscious mode of processing to evaluate the solution found in the previous stage. The parallel-activity technique would then be a self-induced incubation, where the translator would force herself out of the space of the problem by actively and deliberately doing something else which would appear to be totally unrelated to the problem at hand. It is interesting to note the dual nature of cognitive processing in Wallas' model, with problems being solved outside the attentional foci. This would seem to also echo the notion of freeing up cognitive resources, as put forward in expertise studies literature (Shreve, 2006), for example.

Although Kussmaul mentions Guilford's notions of *divergent* and *convergent lateral thinking*, which would entail a broad or focused conscious solution search respectively, he acknowledges that there is no evidence of this in his data (1995, p. 44). He mentions, however, a number of activities, from going to the kitchen to going to the toilet or merely stretching one's legs, that entail a break at the macro-level. Again, we find the dichotomous distinction between attentional processing and non-attentional, or seemingly unconscious, processing as something that occurs in a linear, discreet way: "the subjects unintentionally diverted their attention from the task in front of them and thus created the relaxation necessary for removing the blockage." (1995, p. 51). We posit that the aforementioned cognitive suspension types, which are directly observable on screen, embody this conceptualization of cognitive processing. Given the fact that these forms of suspension do not involve the translator changing their physical location, perhaps these forms are better classified as micro-level phenomena to complement the macro-level phenomena Kussmaul describes.

1.3. Towards a new understanding of parallel activity as cognitive suspension

Following new theoretical and empirical advances in CTS, we would like to extend on Kussmaul's insightful conceptualization of parallel activity. It's interesting to note that his work develops within a TAP paradigm, where problems are the central focus of research attention. This transpires to the point that, as Muñoz and Martín state, 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." (2018, p. 30, original emphasis). But what about the rich information that can potentially be gleaned from breaks and parallel activities that are not necessarily linked to discrete problems? As such, the construct can be quite useful to understand the translation process and fit empirical data that answer, albeit in a limited way, the following questions: do the parallel activities always entail breaks at the macrolevel? Is there a correlation between pauses and parallel-activity techniques? Is there any kind of expertise effect? Do translators engage in this activity only when faced with a cognitive blind alley, or routinely as a way to reset the space of the problem or defragment cognitively? What is the potential relationship between cognitive suspension and cognitive offloading, or "the use of physical action to alter the information processing requirements of a task so as to reduce cognitive demand" (Risko and Gilbert, 2016, p. 676)?

As a first step in the direction of exploring these overarching questions, we set out to investigate the relationship between cognitive suspension as it pertains to parallel activity and translation performance, as measured through errors, typos, and productivity.

2. Research design and methods

We conducted a small-scale exploratory study for the purposes of gauging the impact of cognitive suspension on translation performance from both process and product perspectives. Moreover, this pilot study represents an initial attempt at potentially distinguishing problem-solving in translation, marked by a breakdown in declarative and/or procedural knowledge, from volitional breaks in instances of parallel activities that are not triggered by such breakdown.

2.1 Research questions

In line with the aforementioned focus, we posit the following research questions:

1. Which patterned forms of directly observable indicators of parallel activities, as documented in screen recordings, might suggest cognitive suspension?
2. What impact does cognitive suspension have on errors made in a span of 10 words before and 10 words after its occurrence?
3. What impact does cognitive suspension have on productivity, as rendered through the number of characters generated in a span of 10 seconds before and after its occurrence?
4. What impact does cognitive suspension have on typos frequencies, as rendered through their frequencies in a span of 10 words before and 10 words after its occurrence?
5. Are there any noticeable variations between students and professional translators along the lines of these aforementioned metrics that might suggest an expertise effect?

2.2 Participants

Data for this current study were obtained in the context of two previous studies on problem-solving processes in translation. Ten screen recording excerpts were randomly selected from a pool of twenty screen recordings created by students pursuing a B.A. in Applied Languages at the Zurich University of Applied Sciences. These ten screen recordings were created in conjunction with course assignments. The ten students whose data is represented in the current study were translating from German (L1) into English (L2). Students were taking their second (in a series of four) German-English translation courses at the time the data were obtained, and all had successfully completed the first course in the preceding semester. None of the students had any professional translation experience. They were introduced to screen recording for purposes of self- and other-reflection on translation processes earlier in the course and completed similar activities in a parallel English-German translation practice course.

Two additional screen recording excerpts were obtained from two professional translators who were translating from German (L2) into English (L1) as part of an earlier study on metacognitive bundling (Angelone, 2010). At the time of that study, they each had between five and ten years of professional experience, and both were graduates of the M.A. in Translation program at Kent State University.

2.3 Materials and procedures

Screen recordings were created in conjunction with various translation tasks. In the case of the ZHAW students, these tasks were course assignments. The students created screen recordings on their own computers outside of class using any screen recording application of their choosing from the following options: Screencast-o-matic[1], Flashback Express[2], or QuickTime Player[3]. Screencast-o-matic is entirely web-based and does not require users to download any software. It also can be used on both Mac and Windows operating systems. Flashback Express can only be used on Windows, and QuickTime Player on Mac OS. The two professional translators created their screen recordings using Flashback Express in the context of an on-campus study. None of the obtained screen recordings involved timed translation tasks.

The students were instructed to create screen recordings that were between 10 and 15 minutes in length. They could determine which passage of the translation task at hand they wanted to record, and also which translation (of the ten they completed over the course of the semester). They submitted their screen recordings through a Moodle-based course webpage upon completion. The two professionals translated the same source text. In their case, the entire translation was recorded, and yielded screen recordings that were over 20 minutes in length. Their screen recordings were saved and stored on an external hard drive upon completion.

For purposes of analyses in the current study, eight minutes were selected from each screen recording to serve as an area of interest. The representative eight minutes were taken from the middle of each screen recording, rather than from the beginning or end to mitigate the potential influence of the translator not being warmed up or a fatigue effect.

During an initial analytic pass of each screen recording, we identified the following five behaviors as potential forms of cognitive suspension:

1. Pauses in on-screen activity of 10+ seconds
2. Rapid up/down or left/right scrolling in succession (for no discernable purpose)
3. Random mouse hovering (not over a discernible problem area)
4. Random cycling through tabs or windows in succession (for no discernable purpose)
5. Other (opening/adjusting a music app, foregrounding the desktop/blank screen)

[1] Screencast-o-matic web-based screen recorder: https://screencast-o-matic.com

[2] Flashback Express screen recorder: https://www.flashbackrecorder.com/express

[3] QuickTime Player: https://support.apple.com/en-us/HT201066

In an attempt to document the impact of each cognitive suspension type on translation performance from both process and product perspectives, the following data were calculated using the screen recordings in which the cognitive suspension appeared:

1. Cognitive suspension type
2. Number (and type) of errors occurring in 10 words leading up to the cognitive suspension
3. Number (and type) of errors occurring in 10 words following the cognitive suspension
4. Number of characters generated in the 10 seconds leading up to the cognitive suspension
5. Number of characters generated in the 10 seconds following the cognitive suspension
6. Number of typos occurring in the 10 words leading up to the cognitive suspension
7. Number of typos occurring in the 10 words following the cognitive suspension

Situations in which instances of cognitive suspension yielded fewer post-occurrence errors, a higher number of generated characters post occurrence, and fewer post-occurrence typos were interpreted as evidence of their likely being deliberate, volitional parallel cognitive activities in line with Kussmaul's conceptualization (1995), as opposed to problem indicators suggesting some sort of breakdown in declarative or procedural knowledge. Interestingly, this idea has recently been taken up in the field of cognitive psychology as strategic mind-wandering (Seli et al., 2018), which shows a beneficial effect of cognitive suspension on accommodating environmental demands (see also Mooneyham & Schooler (2013) for a discussion on the effect of mind-wandering on creative problem solving). If these instances, instead, yielded a greater number of post-occurrence errors, a lower number of generated characters, and more typos, they would, instead, be regarded as likely problem indicators, alongside others cited in the TPR literature (Kumpulainen, 2015), such as shorter pauses, external information retrieval, and revisions.

3. Results and discussion

In this section, we provide an overview of the data we obtained in line with the aforementioned research questions as well as our corresponding interpretations of the central findings.

The most frequently-occurring cognitive suspension type exhibited by the students in our study was an extended pause in on-screen activity of ten or more seconds. Of the 37 suspensions in total, 43% fell into this category. While nine of the ten students exhibited pauses of ten seconds or more at some point during task completion, we see variation in frequency patterns from one to the next. For example, Students 4 and 5 both engaged in a total of five cognitive suspensions during the course of observed task completion. None of Student 4's suspensions were of the 10+ second type, while three out of five were in the case of Student 5. These data suggest that, while in the aggregate, pauses of 10+ seconds are typical in student cognitive suspension, variation exists at the level of each individual student's cognitive suspension profile.

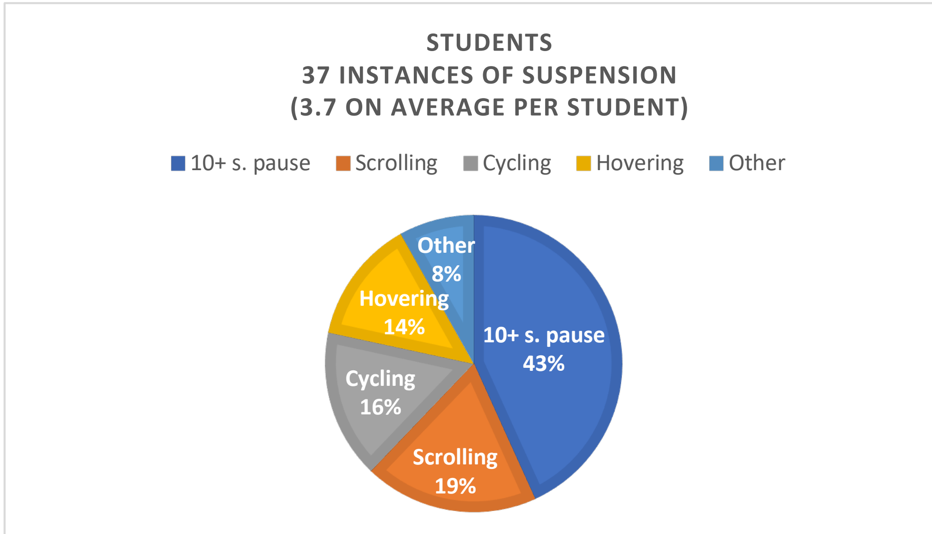

Figure 1: Total number of cognitive suspensions and distribution in students by type

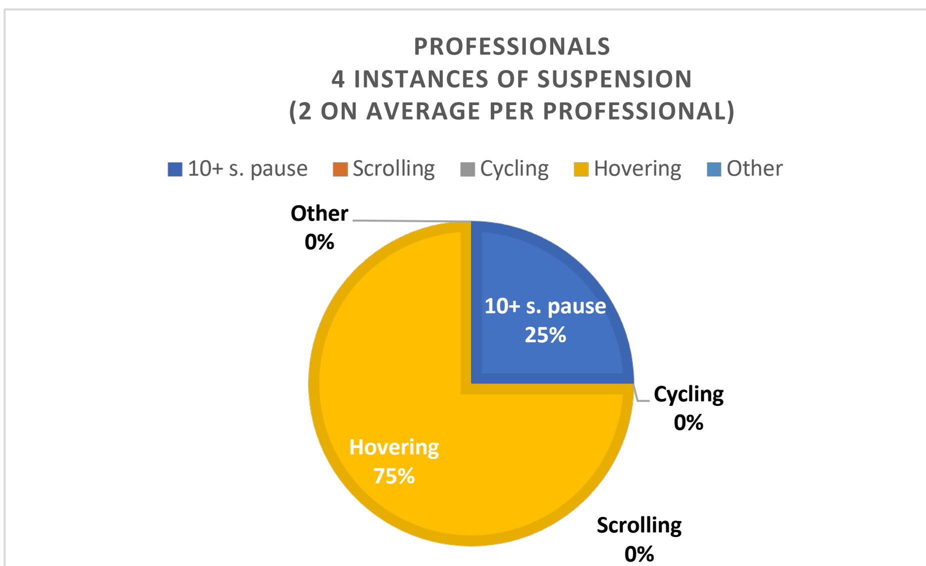

Figure 2: Total number of cognitive suspensions and distribution in professionals by type

The cognitive suspension types of scrolling, cycling, and hovering were relatively evenly distributed in terms of frequency among the students, at 19%, 16%, and 14% respectively. For these suspension types, we see even less overlap from one student to the next. Interestingly, none of the ten students engage in all three of these types within the span of task completion. Instead, we see a common tendency for the students to engage in any one of them in combination with 10+

second pauses. This documented tendency might suggest an upper threshold on the scope of cognitive suspension types used. It would be interesting to explore this from a performative perspective to analyze potential correlations between the scope of suspension (e.g., the number of different types of suspension in which translators engage) and productivity or quality metrics (e.g., the amount of content generated and the number of errors that occur). This variation across subjects may also point to the adaptive nature of translation expertise development, which highly depends on subjects' individual history of successful cognitive tasks (Muñoz, 2014). It might, therefore, be interesting to include the scope and related productivity of suspension in diachronic studies on translation expertise development. In our study, only two of the ten students engage in more than two different suspension types in the course of the task.

The category of "other" involves instances of suspension in which the students did one of the following: adjusting a computer-based music player app in some capacity (such as skipping songs or changing the volume), or returning to an empty desktop screen (for no apparent reason other than to have something non-task-related on screen, i.e., to bring about a deliberate change in the focus of visual attention). In the case of adjusting the music player, a closer analysis of corresponding impact is important in discerning if this was indeed a deliberately undertaken cognitive suspension, or rather motivated by disturbance stemming from undesired cognitive friction (Ehrensberger-Dow, 2015).

The data in Figure 1 reveal that the professional translators in our study engaged in fewer instances of cognitive suspension on average, in relation to the students. Three of their four collective suspensions involved mouse hovering over random areas of the screen, and only one involved a pause of 10+ seconds in on-screen activity. It is important to note that the data collected from professionals was intended to explore a potential expertise effect. To make any significant comparisons beyond this, data would need to be quantitatively balanced across populations to a much greater extent. From a strictly exploratory standpoint, it is worth noting, however, that 10+ second pauses were much more common in the students' data, as were cognitive suspensions in general in terms of overall frequency.

Table 1: The impact of cognitive suspension on error distributions pre- and post-occurrence

Student	Errors leading up to suspension	Errors following suspension
1	5	1
2	8	3
3	3	2
4	12	3
5	10	5
6	9	2
7	10	4
8	12	5
9	9	3
10	10	4

Professional	Errors leading up to suspension	Errors following suspension
1	4	0
2	4	2

Table 1 highlights the strong tendency for cognitive suspension to serve as a remarkably efficacious means for mitigating errors. For nine of the ten students, fewer errors appeared in the ten words following an instance of cognitive suspension than in the ten words preceding it. For eight of the students, error mitigation was at a rate higher than 50%. This was also the case for both of the professionals. These data would seem to verify that these instances of breaks, as instances of parallel activities along the lines put forward by Kussmaul (1995), were, in fact, productive instances of cognitive suspension rather than counterproductive instances of disturbance. Either consciously or subconsciously, the translators defragmented in instances where performance (in this case, in terms of translation quality, as defined through the occurrence of errors) was declining. These breaks, while perhaps necessitating an ephemeral slow-down, can be regarded as an ad hoc means of self-regulated quality assurance for the content generated in the performance windows that follow them.

The efficacy of the cognitive suspension in our study, while conducive to error mitigation on the whole, varies to some extent according to cognitive suspension type, as documented in Figure 3.

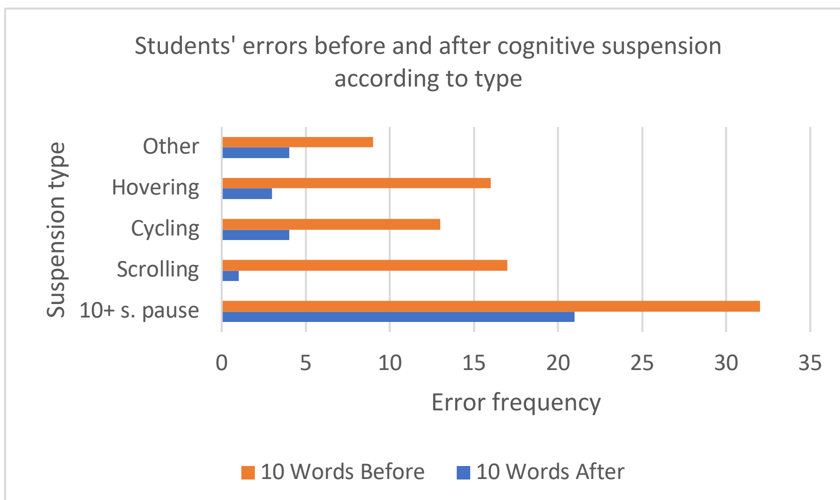

Figure 3. Decrease in errors in relation to cognitive suspension type in students

As we see in Figure 3, random up/down and left/right scrolling was the most beneficial cognitive suspension type for the students in the aggregate from the perspective of error mitigation. Across the population, 17 errors appeared in the ten words leading up to such scrolling, and only one error appeared in the ten words that followed, implying a 94% rate of mitigation. The second most beneficial cognitive suspension type was random mouse hovering, with a before-after error ratio of 16:3 (i.e., an 81% rate of mitigation). Random cycling through tabs or windows yielded a 69% error mitigation rate, "other" a 56% mitigation rate, and 10+ second pauses a 34% mitigation rate.

Of the cognitive suspension types, 10+ second pauses proved to be the least beneficial when it comes to error mitigation. Indeed, the relatively low rate of 34% may point to this type as being more of a break*down* than a breakthrough from a cognitive processing perspective. This would be consistent with the existing TPR literature on pauses in on-screen activity as being classic problem indicators resulting from a faltering of declarative or procedural knowledge. Perhaps the other suspension types are more successful by virtue of the fact that things like scrolling, hovering, and cycling keep the translator physically engaged in some capacity with the environment in which the task is being performed. This maintained physical engagement may free up cognitive resources so that the translator can engage in more successful defragmentation, and, subsequently, more optimal performance, along the lines outlined by Risko and Gilbert (2016) in their description of cognitive offloading.

It is also interesting to note that both random scrolling and hovering are more efficacious for purposes of error mitigation than cycling through tabs or windows. All three cognitive suspension types involve the aforementioned sustained physical engagement, yet cycling, unlike the other two, potentially involves the translator exiting the primary user interface in which the task unfolds. This may, in turn, prove to be a distraction (i.e., a source of cognitive friction) that has a more detrimental impact on error mitigation.

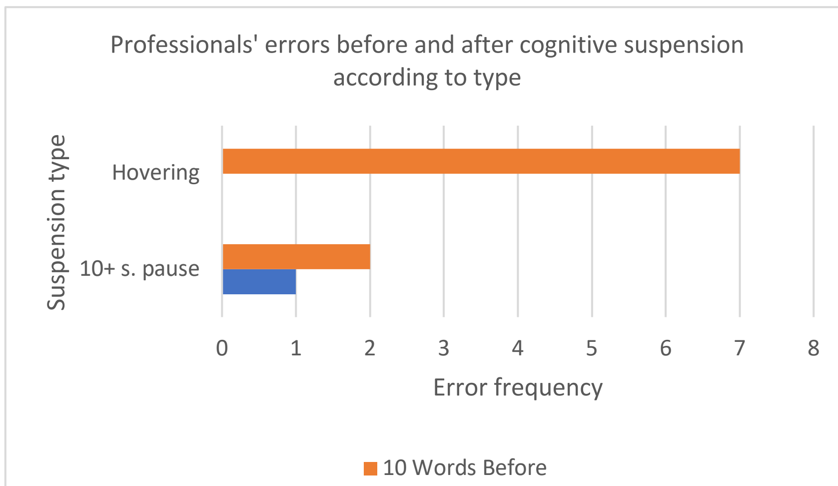

Figure 4. Decrease in errors in relation to cognitive suspension type in professionals

Again, any analyses pertaining to the cognitive suspension behavior of professionals in our study needs to be prefaced by noting the relatively small sample size. That being said, we once again see the relatively weak efficacy of the one 10+ second pause as an instance of cognitive suspension for purposes of mitigating errors. Random mouse hovering, on the other hand, proved to be a particularly successful suspension type for the professionals, with no errors appearing within the ten-word span after their occurrence.

In our study, we obtained some preliminary evidence that professionals engage in cognitive suspension less often than students, and, when they do, they tend to remain physically active during the process through random mouse hovering. In their case, extended episodes of on-screen inactivity transcending 10 seconds are kept to a minimum.

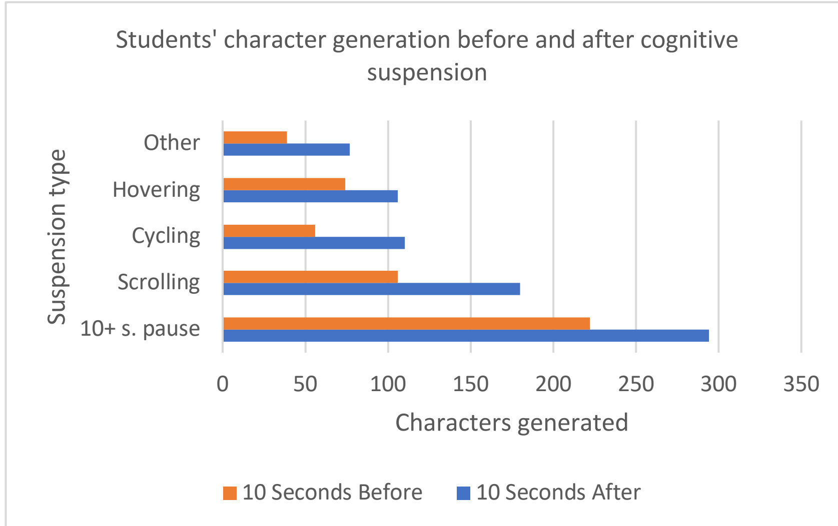

Figure 5. Impact of cognitive suspension on productivity through character generation in students

Let us now turn our attention to the impact of cognitive suspension on translation performance from the perspective of productivity. On the whole, regardless of cognitive suspension type, we see more characters being generated on average by the students in the ten second windows following their occurrence than in the ten second windows leading up to their occurrence. As was the case in the error patterns presented above, cognitive suspension also has a positive impact on character generation as a measure of productivity. Pauses of ten or more seconds in on-screen activity yielded the smallest increase at 25% more characters post cognitive suspension. The cognitive suspension involving random mouse hovering, while conducive in the context of error mitigation, only yielded an increase of 30% more characters. Random scrolling was followed by a 41% increase, while cognitive suspension instances classified as "other" resulted in a 49% increase.

Random cycling between tabs and windows also resulted in a character generation increase of 49%. The efficacy of this cognitive suspension type as a productivity enhancer is of particular interest given its relative weakness as a means for error mitigation when compared with the other cognitive suspension types explored in this study. The level of physical exertion required to cycle tabs/windows and to do something like adjust the volume or skip a song on a music player would seem to be higher than that required for random mouse-hovering or scrolling. Perhaps this greater exertion encompasses both a cognitive and physical tipping point of sorts that results in a greater inherent capacity to generate more characters, albeit potentially at the expense of error mitigation.

The fact that the 10+ second cognitive suspension type had the least positive impact on character generation frequency parallels its weakness in error mitigation, as documented above. This further raises the question of whether or not a pause of 10+ seconds in on-screen activity can be regarded as deliberate cognitive suspension, or rather as a problematic, largely involuntary breakdown, as is so often attributed to extended pauses (albeit of a much shorter duration) in the TPR literature.

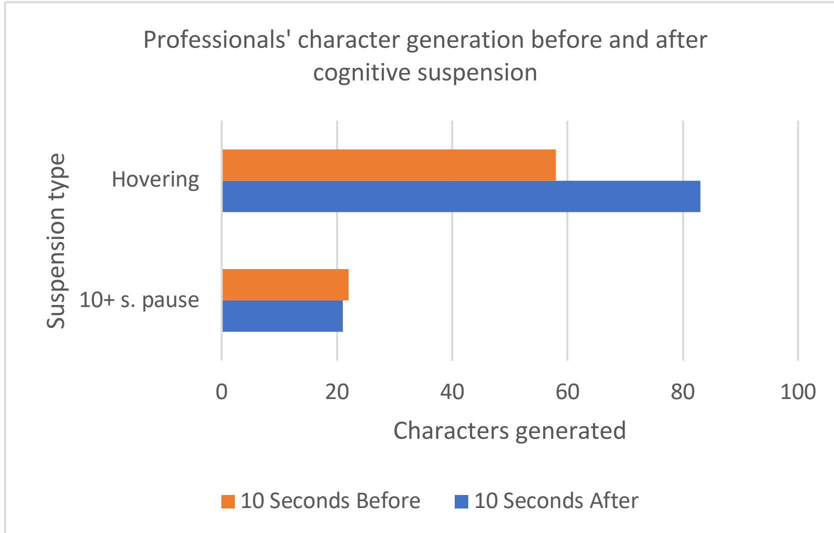

Figure 6. Impact of cognitive suspension on productivity through character generation in professionals

The inefficacy of 10+ second pauses as a type of cognitive suspension for purposes of enhancing productivity through greater subsequent character generation becomes even more evident in the data representing professional translators. We see an almost equal frequency of characters generated on average before and after the suspension. In fact, more characters were generated before the 10+ second pause than after (albeit only one). As was the case in the error frequency component of this study, it seems like professional translators benefit considerably less than students (if at all) from this suspension type.

Random mouse hovering proved to be more efficacious than such pauses for the professionals, resulting in a 30% increase in character generation on average. Again, the data set representing professionals is very limited, and, given the fact that the professionals did not engage in other cognitive suspension types beyond these two, any comparisons should be regarded as precursory.

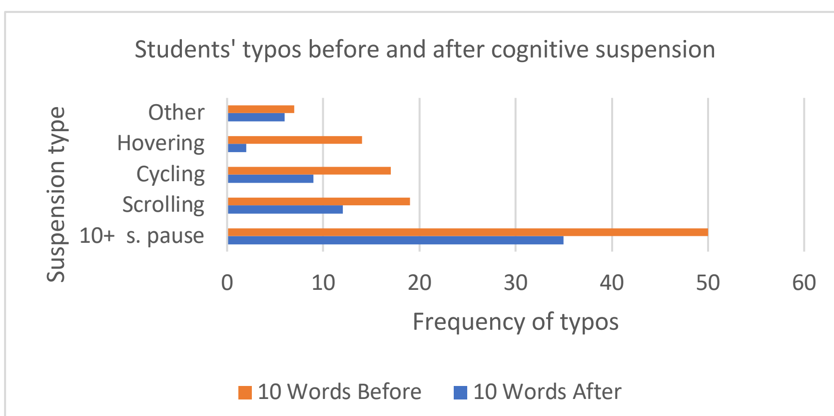

Figure 7. Impact of cognitive suspension on performance through typos in students

A second production metric we analyzed in this study through the lens of cognitive suspension involves the frequency of typos leading up to and following the suspension. In keeping with the other observed patterns, once again we see a positive impact on average for all five of the documented cognitive suspension types in the student data. The suspension type of "other" was least beneficial, yielding a typo improvement rate of 14%. While the heightened physical activity required to change music player settings, for example, had a positive impact on performance in terms of number of generated characters, this does not carry over to mitigating typos. 10+ second pauses resulted in a 30% improvement rate and random scrolling yielded a 37% improvement rate. More significant improvement rates were found for the suspension types of cycling and random hovering, at 47% and 86% respectively. Hovering, in particular, stands out in this regard. Perhaps something about the hand and finger movements that hovering necessitates sets the stage cognitively and physically for fewer typos by enhancing readiness for action. It is interesting to note that the very same necessitated movements do not have a similarly positive impact on character generation frequency.

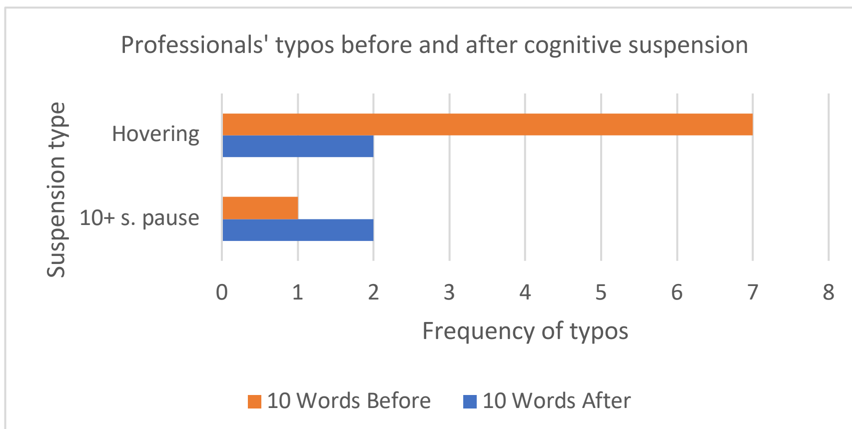

Figure 8. Impact of cognitive suspension on performance through typos in professionals

In this data set, we see the strongest evidence that 10+ second pauses are potentially more of an involuntary, counterproductive problem indicator rather than instances of volitional, strategic cognitive suspension. The professionals ended up producing more typos before the pause than after it. Of course, this finding might not have held true if the professionals had engaged in more cognitive suspensions of this type. In the context of our study, this finding is idiosyncratic in that it represents the behavior of only one professional in conjunction with only one pause.

Random hovering, on the other hand, proved to be quite advantageous for the professionals as a cognitive suspension type when it comes to mitigating typos, with an improvement rate of 71%. So, for both students and professionals, random hovering turned out to be by far the most efficacious cognitive suspension type for mitigating typos.

4. Conclusion and future directions

In this small-scale, screen recording-based exploratory study, we were able to find preliminary empirical evidence for distinguishing what we are putting forward as instances of cognitive suspension, driven by a parallel activity strategy, from what have traditionally been regarded as problem indicators in the TPR literature. Cognitive suspension can be regarded as consisting of deliberate, patterned, volitional breaks that are strategically utilized by translators in a patterned fashion when performance is waning. In our study, the documented cognitive suspension types were shown to be effective in this regard in the aggregate for purposes of mitigating errors and for enhancing productivity in terms of character generation and typo limitation. This was the case for both the student translators and the professional translators whose performance data were collected for the study.

In terms of cognitive suspension type employed, the students, on average, engaged in 10+ second pauses in on-screen activity more than any other, and significantly more often than the professionals. Of the five cognitive suspension types analyzed in this study, the 10+ second pause type proved to be the least beneficial in mitigating errors and enhancing productivity. This leads us to draw the conclusion that, while still holding some benefit as a suspension strategy to some extent, 10+ second pauses in on-screen activity might still be better regarded as a problem indicator that potentially signals a breakdown in declarative or procedural knowledge, rather than as a strategic cognitive process driven by parallel activity.

The cognitive suspension type of random up/down and left/right scrolling resulted in the highest rate of error mitigation for students (94%), while random mouse hovering yielded an error mitigation rate of 100% for the professionals in our study. It is worth noting that both of these cognitive suspension types involve the translator staying within a static user interface. Other cognitive suspension types, such as the random cycling through tabs or windows in which the user interface is no longer static, proved to be less effective in error mitigation.

From a productivity perspective, on the other hand, this random cycling was the most conducive cognitive suspension type for students in terms of character generation. From a physical ergonomics perspective, the degree of physical exertion required for such cycling is higher than the exertion needed for other suspension types, such as random scrolling or hovering. This may, in turn, serve as a catalyst for character generation. However, this positive impact does not carry over to the same degree when examining the second productivity metric in our study, namely, frequency of typos. Instead, random mouse hovering was the most conducive cognitive suspension type for typo mitigation among the students and professionals alike.

In summary, it is important to emphasize again that these findings are preliminary, and the results warrant more extensive empirical investigation. We hope that follow-up studies on the cognitive suspension types we have put forward will involve much more robust data collection and explore how things play out in line with a number of potentially interesting variables. For example, how might the documented suspension types and patterns vary if the participants primarily work in a TM/MT environment? In this regard, we see cognitive suspension analyses fitting in nicely with some of the recent empirical research on CAT tool usability (Krüger, 2016; O'Brien et al., 2017). From a cognitive and physical ergonomics perspective, it would also be interesting to examine patterns as they unfold in the context of a longer translation task. What is the impact of cognitive suspension in terms of quality and productivity in multiple eight-minute screen recording excerpts that occur at different stages of the project?

We also encourage the TPR research community to examine additional cognitive suspension types that are likely manifest when other data collection modalities are used. For example, in eye-tracking-based research, such instances of suspension are potentially at the fore when translators deliberately look away from the screen or look at seemingly completely random areas of the screen, or when touch typists deliberately focus on the keyboard when generating content.

We also hope our study motivates new strands of exploration in the domain of process-oriented translator training. In the context of self-awareness training, students could be encouraged to become aware of the concept of cognitive suspension and which types work (and do not work) well for them. Not unlike what we see in screen recording-based problem awareness training, cognitive suspension awareness training can enhance the saliency of phenomena that might otherwise go unnoticed with an ultimate objective of enhancing student performance.

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