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On the operationalisation of 'pauses' in translation process research

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Abstract: This article discusses the various ways in which pauses have been operationalised in translation process research. The factors used to determine the significant pause length in various research settings will be reflected upon: different types of data yield different kinds of pauses, the lengths of which having been determined based on the aim and purpose of each study. In addition, different data collection methods provide different possibilities with regard to the exactness of pause length measurements. Hence, the significant pause length is a variable that must be determined and justified in each study to correspond to the research goals.

Keywords: translation process, cognitive processing, pause, research methodology

1. Introduction

This article will focus on the operationalisation of pauses in translation process research and their ability to explain some cognitive processes in translation. This review of the literature is motivated by the author's Ph.D. project, which investigates the acquisition of translation competence during translator training and in which pauses must be taken into account in the analysis.

Based on the stimulus-response paradigm in cognitive psychology, a pause is considered to signal cognitive effort in various kinds of complex processes involving planning and problem solving: "The more the delays, the more cognitive operations are required by the output" (Butterworth, 1980, p. 156). Pause analysis has been a frequently applied methodology in studies focusing on spoken or written language production — for example in the fields of second language acquisition, writing research, and translation. To mention some recent examples, a pause can be taken to measure the speech fluency of second language learners (Kapranov, 2013), to indicate cognitive processing when sentences are copied by second language learners (Zulkifli, 2013), and to study differences between the monolingual writing process and translation (Immonen, 2011). It should be noted, however, that although pauses *can* indicate cognitive processing, they can be influenced by a number of other factors, and with current data collection methodologies it is virtually impossible to identify the specific motivation of a particular pause (O'Brien, 2006, p. 7). Pauses can be the result of cognitive processing, but can also manifest from a distraction that is unrelated to the text production process. To mitigate for this potential confound, researchers may find it worthwhile to look at pauses in conjunction with participant behaviour that immediately precedes or follows the observed pause (Schilperoord, 2001, p. 61).

Despite the lack of understanding as to what motivates a specific pause during text production, researchers have adopted pauses as an indicator of cognitive effort in translation as well. Translation can be regarded as a complex cognitive task that involves planning and problem solving linked with interlingual and intercultural processing. This cognitive effort may manifest, among other possibilities, as a pause in the translation process. Consequently, a pause's potential as an indicator of problem recognition and problem solving makes it relevant to various purposes within translation process research.

However, a question arises as to the length of time in the process that qualifies as a pause. To operationalise the concept of a pause for the purpose of the author's study, a critical review of research that relies on this indicator is needed. This article gives an overview of such studies: first, a brief overview of the variation in the nature and length of pauses will be provided. Second, probable explanations for the variation will be offered by accounting for data collection methods used in translation process studies as well as different aims of studies.

2. A pause in translation process: An overview of the variation

In translation, a pause may signify both problem-free and problematic processing. In problem-free production, a translator pauses to read the following chunk of the source text (ST) and processes it in order to transfer the message before typing (Dragsted, 2012, p. 92). Differences in pause duration seem to be related to differences in processing time, to the extent that longer pauses can be taken to indicate a relatively larger cognitive effort caused by some kind of complexity. Thus, a pause may not merely signal a problem-free shift from one text production segment of text to another, but may also serve as an indicator of difficulties or problems encountered in the translation process. A problem may be related to the next chunk in the ST that a translator is considering, or as Schilperoord (1996, p. 11) states, a pause may signal a problem that is perceived in the target text (TT), requiring monitoring and revision actions of the previously produced segments. According to the results of Dragsted and Hansen's (2008, p. 25) eye tracking experiment, a pause in the translation process could also be interpreted as a "run-up" to production — i.e., a transition from source language (SL) comprehension to target language (TL) production, since what seems to take place during one segment is TT production *as well as* reading/comprehension of the following ST chunk.

In addition to variation as to the probable cause of a pause, differences arise in the literature as to the duration of what is regarded as a significant pause. Each study in the field of translation process research must define the minimum pause length for the purpose of analysis (Englund Dimitrova, 2005, p. 96–97). As Krings (1986, p. 137), Jakobsen (2003, p. 89) and Alves and Vale (2009, p. 255) point out, it is not clear how long an interruption in the text production process should be to qualify as a pause. Including pauses that are very short may lead to the identification of automatic processes that do not relate to problem solving, whereas long pauses may fail to yield any significant behavioural information. Whatever the value chosen to signify a "significant pause", it is bound to be arbitrary (Englund Dimitrova, 2005, p. 96-97) since there is no way of knowing when exactly a pause in translator's processing is long enough to signal a problem or planning. However, it is possible to make the definition of a significant pause less arbitrary by taking individual differences in processing into account. Dragsted (2004) calculates the size of the translation unit in relative times with respect to the individual

typing speed and the time spent by each of her subjects — thus, the length of significant pauses is also individual. Despite the obvious merits of her approach, most studies in translation process studies have resorted to a fixed value.

Using a fixed pause length can be traced back to Krings' pioneering study (1986), in which a meaningful pause is set at three seconds: process interruptions shorter than this value are not regarded as pauses (Krings, 1986, p. 137). Angelone (2010) and Göpferich (2010) adopt the same threshold, while Lörscher (1991, p. 109) establishes a minimum value of 2 seconds. For Jensen (2000), a meaningful pause is 4 seconds. Dragsted et al. (2009) consider the significant pause length to be 2.5 seconds; however a study reported a year later by Dragsted (2010) takes into account pauses of more than 1 second. Jakobsen (2003) and Englund Dimitrova (2005) include pauses of at least 5 seconds in their analyses, while Jakobsen (1998) sets a limit of 1 second. According to Jakobsen, pauses of more than 10 seconds that appear less systematically (i.e., excluding initial and final delays and delays between paragraphs) signify particularly difficult text segments (ibid., p. 84). The value of one second is also chosen by Alves et al. (2010). However, in Alves and Vale (2009), a significant pause length is 5–6 seconds. PACTE (2005) also accounts for interruptions in text production of 5 seconds when examining problem indicators in a translation process. For Immonen (2006, 2011), even the miniature pauses of 0.01 seconds are of interest.[1]

Clearly, there is considerable variation in the operationalisation of pauses in different research settings: while one study views tiny pauses as significant, another excludes intervals shorter than 5 seconds. This variation may seem haphazard, but the seeming arbitrariness has a logical explanation. First, the difference in the significant pause lengths between studies stems from the different data collection methods and thus, from the different nature of pauses. A pause in one data set tells a different story than a pause in another data set. In addition, the technology imposes certain limits with regard to the exactness of measurements. Second, the variation may be explained by different study objectives. The different types of data used in process research studies will be discussed in the following section, after which the various goals of process research studies that influence the determination of a pause duration will be introduced.

3. Types of data used in translation process research

The first studies focusing on translation process rather than the product were carried out in the late 1980s. These think-aloud protocol (TAP) studies borrowed their data elicitation method from cognitive psychology where it had been used to study various problem-solving and decision-making processes (Jääskeläinen, 2000, p. 71). The underlying assumption is that participants have access to the translation process and this access can be verbalised aloud, which can provide insight into human thought processes. However, whenever the cognitive load increases, participants tend to stop verbalising because attention cannot be allocated to too many operations at the same time (Jääskeläinen, 1999, p. 57–58). Thus, in process studies that rely on TAP data, pauses refer to breaks in subjects' verbalisation which is recorded and transcribed in protocols.

[1] See also the discussion on meaningful pauses in post-editing in Lacruz, Shreve, and Angelone (2012) and Lacruz and Shreve (2014). The authors argue that it is not only the length of pause that is relevant when looking at a pause as an indicator of cognitive effort but also the pause density that matters—short pauses of 0.5 seconds appearing in clusters may also indicate cognitive effort.

New insight into the translation process was made possible by the adoption of keylogging programs; one such example is that of Translog[2], which was developed by Jakobsen and Schou (1999). Translog is a program that allows researchers to record a variety of writing tasks done on a computer keyboard without interfering with the writing process. The program registers all keystrokes, changes, deletions, additions, cut-and-paste operations, and cursor movements during the writing process. Translog also records timestamps — i.e., logs information about the exact time at which each keystroke operation is made — thus enabling a numerical representation of the pause duration that occurs when typing. As opposed to TAP data, pauses in Translog data refer to breaks in the writing process, or to be more exact, in keystroke operation. Another program, PROXY, provides similar data, with the addition of showing translator's use of other software and search engines (Alves and Hurtado Albir, 2010, p. 32). Translog enables the study of pauses as short as 0.01 seconds, although most studies that have used Translog to collect data have set a pause value between 1–5 seconds. The minimum length of pause can be defined in the settings in order to exclude shorter intervals from the automatically produced numerical data.

Data collection with various screen recording software such as Camtasia offers further insight into the translation process (www.techsmith.com) and provides information about the pauses that the user makes. Screen recording programs records the translation process of the participant as a video file that shows the process exactly as it takes place on the screen. The method does allow for pause analysis, but to a limited extent; unlike Translog, Camtasia does not provide any numerical data, and therefore the timing of pauses must be done manually by the researcher after data collection, using the player's pause function along with the program timer running on seconds. Similar to Translog, pauses in screen recording data refer to breaks in the writing process, but the determination of a pause is based on moments during which nothing takes place on the screen. Therefore, pauses in the two kinds of data cannot be considered identical, since screen recording data provides information that is not present in Translog data, such as information search and dictionary look-ups. Consequently, the researcher has access to additional information that may be a glimpse into the problem-solving process.

Eye tracking as a data collection method in cognitive translation research has opened a new window into the translation process and a translator's pausing pattern. With equipment such as the Tobii eye tracking system a researcher can follow the gaze of a translator — what she is looking at any given moment during the translation process — and in this way receive information on the translator's cognitive processing. The use of eye gaze as an indicator of cognitive processing is based on the assumption that what the eye is looking at is what the mind is attending to, i.e., that there is a correlation between behavioural "outside" data and cognitive "inside" processing (Just and Carpenter, 1980, in Jakobsen, 2011, p. 38). Its major contribution to process studies is to shed light on what has previously been an uncharted territory in the translation process, namely the reading phase. Eye tracking provides a veritable sea of data: gaze plots showing the number and sequence of fixations, hotspots showing the areas on the screen that were most frequently fixated, video files showing the eye gaze, reading and text production data. In addition, each eye tracking recording also produces a very large data file with millisecond-based data on eye movement on the screen (O'Brien, 2009, p. 260–261). A pause in an eye gaze data refers to an instance when no fixation can be detected by the program, in other words, to moments

[2] Translog is available online at www.translog.dk. Other keylogging programs used in writing process research include Scriptlog, Inputlog and EyeWrite (http://www.writingpro.eu/logging_programs.php).

when the translator is simply not looking at the screen (Dragsted, 2010, p. 57).[3] Thus a pause is very different in nature than in other types of data: the breaks during which a translator reads the ST (for comprehension) or the TT (for evaluation) are included in the eye gaze data. In addition, a new variable to measure time lag in translation has been introduced into process studies along with the eye tracking method: the time that elapses between visual fixation of the ST input and the typed production of the TT output is referred to as an *eye-key span* (Timarová et al., 2011, p. 123; Dragsted, 2010, p. 42, 50).

Given the different types of data that are obtained from the previously discussed methodologies, one type of data alone is likely to be insufficient to provide significant insight into the translation process. Therefore, studies in translation process research increasingly resort to data triangulation in an effort to minimise the amount of pauses that cannot be explained and therefore to gain a more comprehensive understanding of the process. In these studies it is vital to clarify whether a pause refers to a data elicited by a single method or to a pause in the triangulated data as a whole. Göpferich (2010, p. 7–8), for example, used think-aloud protocols along with observation, screen recording, keystroke logging (Translog) as well as questionnaires as data collection methods. In her research, a pause as one (secondary) indicator of problem awareness and problem solving refers *to an unfilled pause in the translation process protocols* in which the think-aloud verbalisations as well as the participants' other activities such as consultation of external resources and reading the ST are transcribed. In other words, pause refers to instances in which a break in verbalisation is not filled by activities apparent in other types of data. In Angelone (2010), who uses a two-pronged approach via think-aloud protocols and screen recording in order to account for translators' uncertainty management during the translation process, a pause has to do with "non-articulated problem recognition behaviour" (p. 20). That is, Angelone notes pauses in screen recording data, such as scrolling over a given ST unit (with or without synchronous articulation) and repositioning the cursor, and considers "extended pauses" of more than 3 seconds in the screen recording data as problem indicators (ibid. 36). Contrary to Göpferich, Angelone does not pay attention to pauses in the think-aloud data: only direct or indirect articulations are considered problem recognition in the TAP data.

In their large-scale project into the nature and acquisition of translation competence, PACTE (2005, p. 611, 613) view pauses as one of the most relevant "categories of action" that are observable on the basis of PROXY recordings and direct observation — i.e., pauses are documented not only by means of text production data recorded by PROXY, but also by means of a direct observation chart in which the researcher records observable participant behaviour. A pause in PROXY data may not coincide with a pause in direct observation data: if a participant is reading, there is apparently a pause in the PROXY data, while direct observation explains the reason for the pause in writing. Thus, direct observation complements the data logged by PROXY, much in the same way as eye tracking data complements data based on text production, by clarifying what happens during the pauses in the writing process. In Dragsted (2010), who combines Translog and eye gaze data, pauses refer to gaps in the data stream as a whole, either in gaze data or text production activity, i.e., during the pauses, when translator is neither looking at the screen nor operating the keyboard.

[3] Although long fixations in eye tracking data, from the research point of view, also indicate a pause in the translation process, they are not referred to as 'pauses' in the data, since they are not "interruptions in the data stream" (Dragsted 2010, p. 42). However, it could be argued that long fixations are similar to pauses in the sense that they *can* indicate cognitive processing, but they can also be influenced by a number of other factors (see O'Brien 2006, p. 7).

In sum, the overview of data collection methods in translation process research shows that a pause may vary widely depending on the data elicitation method and can be motivated by a variety of factors. The duration of a pause is variable, most often set between 0.01–6 seconds in translation process studies. In addition, some variation in the duration and exactness of pauses can be explained by the technological differences of data collection tools: while keystroke logging allows exact measurement of the shortest of breaks, think-aloud protocols, screen recording, or any data collection method that requires manual timing must settle for coarser measurements. In screen recording with Camtasia, for example, timing must be carried out after the data collection: when analysing the video file, the researcher presses the pause button whenever a subject stops writing in order to take note of the time (the exact moment is hard to capture), then releases it and measures the time lapse until the translator starts writing again or performs another function using the keyboard, to then pause to stop the timer in order to calculate the interval as precisely as the technology allows. It is technically challenging to document pauses of less than 2 to 3 seconds.

However, the method chosen does not provide the main explanation for the apparent discrepancy in the use and definition of "significant" pauses as indicators of cognitive effort in translation process research. Instead, the primary explanation arises from the different research aims and purposes that necessitate specific types of data. Regardless of the value chosen for a significant pause and how the pause is defined its nature, the decision should be motivated by the purpose and aims of the study. The following section offers an account of how pause has been operationalised for various research purposes and aims.

4. Goals of studies using pauses as an indicator of cognitive processing

As mentioned previously, different data collection methods vary in their potential to provide information on pausing patterns, with regard to the nature of pauses as well as to the precision in their measurement. The choice of method should, naturally, arise from the purpose of a study, its goals and hypotheses, which in turn motivate the relevance and definition of a pause within the study. The data collection method may impose some boundaries or limits, but does not dictate the duration of a significant pause: instead the researcher must make this determination for each study.

Therefore, studies using the same data collection methods may opt for different pause definitions or interpret the data differently. Krings (1986, p. 137) aims at identifying different types of translation problems, and argues that the operationalisation of pauses must be carefully considered because the data is collected with a simple tape-recorder with no timing function. He decides on a three second value, most likely considering it to be the shortest pause that can be reliably recorded due to the technical limitations of his data collection method. In Krings' study, only pauses that are not filled by writing are taken into account. Unfilled pauses are considered as secondary problem indicators, meaning that they imply a problem in the process if at least one other problem indicator can be identified, whereas primary problem indicators are sufficient for problem identification. For example, if a subject does not utter anything for more than three seconds and this pause is followed by a sigh (another secondary problem indicator), the participant is, according to Krings (1986), experiencing a problem. Jääskeläinen (1999, p. 166) also regards a pause as a secondary problem indicator, which she, however, decides to exclude from the data analysis since "their functions seem to be highly idiosyncratic" and therefore, "would be difficult to determine how many secondary indicators would be required for identifying marked processing."

In studies using Translog data, the notion of a significant pause has varied greatly. Jensen's (2000, p. 108) goal is to investigate whether time pressure has any effect on translation — e.g., this type of external influence could impact problem-solving activity. For Jensen, a Translog data file that included a 4-second pause could be one indicator of a potential problem-solving activity among various other indicators. She chose the value of 4 seconds to suppress delays resulting from differences in writing speed, finding it appropriate after comparing log-files with think-aloud data. It could be argued, on the basis of Dragsted's individual measurements mentioned below, that less than 4 seconds is enough to account for differences in typing speed; however, Jensen's aim was not to define segmentation patterns on the basis of pausing. Rather, Jensen attempts to identify where problems may occur, since problem identification and problem solving presumably requires more cognitive effort than "normal" changes in the attentional state. This change requires the retrieval of readily accessible information from long term memory (Dragsted, 2004: 75), and therefore the value for a "significant pause" can be set higher.

In Jakobsen's study (2003), the goal was to determine whether thinking aloud as a data collection method has any effect on the segmentation pattern of translators. Jakobsen (ibid., p. 89) states that it is not clear what pause length would constitute a good criterion to determine the boundaries of segments; in the end, an ad hoc segment definition took any length of keystrokes between pauses of at least 5 seconds to constitute a segment (ibid., p. 90). While it can be argued that a smaller value may have provided a more exact picture of the segmentation, the results of the study show that a 5-second pause was sufficient to show the difference in segmentation patterns with and without subjects' thinking aloud while translating. If the results had been similar in both experiments, it might have been necessary to conduct further experiments with a lower value. In Jakobsen's study 5 years earlier, the value is set as low as 1 second, but its aim is to shed light on the nature and distribution of time delay in translation in general. Jakobsen (1998, p. 83) states that "one second is appropriate because it represents all the delays we want to identify."

For Dragsted (2004, 2005) the pause length is the decisive factor in her study on cognitive segmentation patterns of experts and novices. Dragsted (2005, p. 53) states that "comparing all subjects on the basis of the same pause unit value would amount to comparing the motion of a turtle and a leopard as if they both belonged to the same species of animals." This is based on the assumption that participants think and work at different paces and have different text production speeds: for a fast typist and processor, a pause of 1.5 seconds, for example, may signal hesitation or another segment boundary, whereas a slower text producer may typically break between words at her typing speed. Thus, in order to investigate cognitive processing instead of typing skills, Dragsted applies different pause values to individual subjects depending on their total production speed, which then enables her to make observations on segmentation that are independent of individual differences. Without going into details of the procedure itself, the resulting pause unit values range from approximately 1 second to approximately 2 seconds.

In Immonen (2006, p. 313-315) the significant value is set as low as 0.01 seconds. Immonen's aim is to find out whether translation as a writing process differs from a monolingual writing process, and if so, in which aspects. Immonen focuses on pause qualities in *fluent production*, which refers to typing uninterrupted by corrections, deletions or cursor movements. By doing so, she seeks answers to questions such as how pause time is distributed in fluent text production and fluent translation, and how this distribution may differ in text production and translation. By setting the values as low as

possible in the Translog program, she can detect even the most miniature — yet statistically significant — differences.

In Alves and Vale (2009), another attempt is made to characterise the translation unit from a cognitive point of view, i.e., to shed light on segmentation in translation. The researchers refer to two kinds of translation units (TUs): micro-TUs and macro-TUs. Micro-TUs consist of a text production segment, including deletions, additions and other possible changes implemented on-line, located between two pauses that fall below the threshold of five/six seconds, which, according to Alves and Vale (2009, p. 255), is a mean pause length on which translation process researchers tend to agree. Macro-TUs, in turn, are composed of a collection of micro-TUs that include all interim text production that follows the translator's focus on the same ST segment from the first tentative rendering to the final output that appears in TT. However, the researchers (ibid.) do not randomly select the value to be used, but rather justify their choice by testing whether lower values of 3 and 1 seconds would make a difference in informants' segmentation pattern and foci of attention. Alves and Vale (2009) find that this is not the case, with the exception being for 1 second interval showing pauses caused by typos, and perhaps, slower writing speed. In other words, the researchers choose the 5-second interval because it seems to be sufficient to show the features that were of interest in their study.

However, in Alves et al. (2010) an interval longer than or equal to 1 second is determined as the marker of micro translation units (cf. the previous discussion of Alves and Vale, 2009). According to the researchers (ibid., p. 128), their study provides evidence of highly meaningful one second pauses that reveal differences in the segmentation pattern in the demetaphorisation process. While one translator has 20 intervals when translating the text segment (represented by a pause length of one second), another translator needs only seven intervals, which according to Alves et al. (2010, p. 130–131) already signals that the translator with 20 intervals exerts more effort into the translation of the segment. In other words, one second pauses may prove highly significant when clustered within a certain time span. Other researchers, such as Lacruz et al. (2012), provide similar ideas with regard to cognitive effort in post-editing, particularly with regard to pause density.

Dragsted (2010) investigates an area that has not been sufficiently studied, namely how translators coordinate their reading and writing processes in translation. She combines eye tracking with Translog data, and pauses necessarily take a different form in her analysis. In her study, there are two types of pauses: first, eye-key span (EKS) provides the time lag between any fixation on a ST word and the production of its TT equivalent. The span is calculated on the basis of time stamps (milliseconds) in the eye gaze data and can tell the time lapse between the first or the last fixation of the word and its production in TT. As Dragsted wants to establish differences in EKS values between novices and more experienced translators, no preset threshold EKS value proved relevant. Second, though pauses in the Translog data are to a large extent "filled" with eye gaze data and thus the amount of unexplained pauses in the data has decreased, pauses still occur in the data stream during which no traceable activity can be detected. Dragsted (2010, p. 56) takes pauses of more than 1 second into account, relying on Jakobsen (1998) and Dragsted (2005) who have shown that pauses of 1-2 seconds indicate some translation-related cognitive processing. What exactly happens during these pauses is unclear: a translator may be looking at the keyboard searching for the right key (in which case it would be an indicator of typing skills), but in majority of cases, no obvious explanation can be found. With the adoption of eye tracking into the process studies, these kind of pauses are the new "blanks and silences we have to fill in," to use Jakobsen's description of pauses in Translog data (Jakobsen 1999, p. 15). According to Dragsted (2010, p. 57),

one possible explanation could be that eyes drift when participants experience difficulties or concentrate intently, suggesting that pauses in this kind of data signal particularly demanding cognitive processing: participants look away from the screen or close their eyes to avoid the distraction of words on the screen when thinking about the solution or grasping the meaning of ST. If this were the case, these pauses are indicators of problem solving as is the case with other data. This assumption has not to date, however, been verified by empirical research.

In sum, the relevant pause length derives from the aim and purpose of the study. Furthermore, the data itself may dictate the lowest value worth analysing: values need not be established very low if all or clearly the majority of pauses that are analysed seem to exceed that value.

5. Conclusion

When looking into the methods and aims of various process studies, the variation in pause lengths appears logical and methodologically sound. While it cannot be denied that the interval length considered as significant is to some extent arbitrary, the findings from studies in other fields, particularly in writing research (e.g. Schilperoord, 1996; for a comprehensive overview on the status of pauses in discourse production see Schilperoord, 2001), give some guidelines in the operationalisation of the concept. Some studies clearly describe the rationale for choosing a certain value, while in others this information is notably absent. Explicit justification is of vital importance, however, since a pause is not, as described above, a given measurement with a similar role as an indicator of cognitive processing in each study.

When the focus of the study is on translation uncertainty and translation problems, it seems that the pause length can be set at a somewhat higher level than when the aim of the study is to investigate segmentation patterns in translation – problem spots seem to require more cognitive effort and subsequently take more time to resolve. When the interest lies in the segmentation pattern, both fluent text production and problematic sequences are analysed, and the value must be set lower in order to account for fluent, unproblematic sequences of translation. However, it appears that in some cases short pauses may also indicate problems in process: several 1-second pauses clustered in a segment can be regarded as an equally clear indication of extra cognitive effort as one long pause in a segment.

Furthermore, the more central the role of a pause in the analysis, the more care is needed in its definition, i.e., the results are more distorted if the significant pause length is not carefully considered and justified. Nevertheless, the use of pauses as the sole indicator of planning or problem recognition and solving in the process can be considered somewhat unreliable, since a pause in any data set refers to a blank spot in processing, and what exactly happens in the translator's mind during this break remains unknown. Data triangulation is useful to decrease the number of these gaps: the more data elicitation methods are used, the fewer unexplained pauses there are when all data is analysed as a whole. Moreover, the more data elicitation methods are used, the greater the number of other process features that indicate problems or planning become observable, and by extension, pauses no longer need serve as the sole indicator of cognitive effort. To this day, however, no combination of data elicitation methods allows a complete account of translator's cognitive processing.

In sum, whatever the value determined as a significant pause, it must be specific enough to reveal the aspects of process in which the researcher is interested. The data elicitation method should be chosen according to the aims of study, bearing in mind that methods differ with regard to their potential to measure pauses. When the method has not been carefully considered prior to

the research, the significant pause length may have to be determined as a compromise between the level of specificity provided by the data elicitation method and the limitations imposed by its collection.

About the author

Minna Kumpulainen works currently as a Junior Researcher at the University of Eastern Finland, preparing a PhD thesis on the acquisition of translation competence in the context of BA level translator education. Her longitudinal study looks into both translation products and processes of a group of BA students and describes how students' performance changes during their studies. Kumpulainen has also worked as a University Teacher for several years, with translation from English into Finnish on both BA and MA levels as her main responsibility.

References

Alves, F., & Hurtado Albir, A. (2010). Cognitive approaches. In Y. Gambier & L. van Doorslaer (Eds.), *Handbook of translation studies*, vol. 1 (pp. 28–35). Amsterdam: John Benjamins.

Alves, F., & Vale, D. (2009). Probing the unit of translation in time: Aspects of the design and development of a web application for storing, annotating, and querying translation process data. In S. Göpferich & R. Jääskeläinen (Eds.), *Process research into translation competence, special issue of Across Languages and Cultures, 10*(2), 251–273.

Alves, F., Pagano, A., Neumann, S., Steiner, E., & Hansen-Schirra, S. (2010). Translation units and grammatical shifts. Towards an integration of product- and process-based translation research. In G. Shreve & E. Angelone (Eds.), *Translation and Cognition* (pp. 109–142). Amsterdam/Philadelphia: John Benjamins.

Angelone, E. (2010). Uncertainty, uncertainty management and metacognitive problem solving in the translation task. In G. Shreve & E. Angelone (Eds.), *Translation and Cognition* (pp. 17–40). Amsterdam/Philadelphia: John Benjamins.

Butterworth, B. (1980). Evidence from Pauses in Speech. In B. Butterworth (Ed.), *Language Production. Volume 1. Speech and Talk* (pp. 155–176). London: Academic Press.

Dragsted, B. (2004). *Segmentation in translation and translation memory systems*. *An empirical investigation of cognitive segmentation and effects of integrating a TM system into the translation process*. (Ph.D. Thesis. Ph.D. Series 5). Copenhagen: Samfundslitteratur.

Dragsted, B. (2005). Segmentation in translation. Differences across levels of expertise and difficulty. *Target, 17*(1), 49–70.

Dragsted, B. (2010). Coordination of reading and writing processes in translation: An eye on uncharted territory. In G. Shreve & E. Angelone (Eds.), *Translation and Cognition* (pp.41–62). Amsterdam/Philadelphia: John Benjamins.

Dragsted, B. (2012). Indicators of difficulty in translation – Correlating product and process data. *Across Languages and Cultures, 13*(1), 81–98.

Dragsted, B., & Hansen, I. G. (2008). Comprehension and production in translation: A pilot study on segmentation and the coordination of reading and writing processes. In S. Göpferich, A. L. Jakobsen, & I. M. Mees (Eds.), *Looking at Eyes. Eye-Tracking Studies of reading and translation processing* (pp. 9–29). Copenhagen Studies in Language 36. Copenhagen: Samfundslitteratur.

Dragsted, B., Hansen, I. G., & Sørensen, H. S. (2009). Experts Exposed. In I. M. Mees, F. Alves, & S. Göpferich (Eds.), *Methodology, Technology and Innovation in Translation Process Research* (pp. 293–317). Copenhagen: Samfundslitteratur.

Englund Dimitrova, B. (2005). *Expertise and explicitation in the translation process.* Amsterdam/Philadelphia: John Benjamins.

Göpferich, S. (2010). The translation of instructive texts from a cognitive perspective: Novices and professionals compared. In S. Göpferich, F. Alves, & I. M. Mees (Eds.), *New Approaches in Translation Process Research* (pp. 5–52). Copenhagen Studies in Language 39. Copenhagen: Samfundslitteratur.

Immonen, S. (2006). Translation as a writing process: Pauses in translation versus monolingual text production. *Target, 18*(2), 313–336.

Immonen, S. (2011). Unravelling the processing units of translation. *Across Languages and Cultures, 12*(2), 235–257.

Jääskeläinen, R. (1999). *Tapping the process: An explorative study of the cognitive and affective factors involved in translation*. Joensuu: University of Joensuu.

Jääskeläinen, R. (2000). Focus on methodology in think-aloud studies on translating. In S. Tirkkonen-Condit & R. Jääskeläinen (Eds.), *Tapping and Mapping the Processes of Translation and Interpreting* (pp. 71–82). Amsterdam/Philadelphia: John Benjamins.

Jakobsen, A. L. (1998). Logging time delay in translation. In G. Hansen (Ed.) *LSP texts and the process of translation*. *Copenhagen Working Papers in LSP* 1/1998, 73–101.

Jakobsen, A. L. (1999). Logging target text production with *Translog*. In G. Hansen (Ed*.), Probing the process in translation: Methods and results* (pp. 9-20). Copenhagen Studies in Language 24. Copenhagen: Samfundslitteratur.

Jakobsen, A. L. (2003). Effects of think aloud on translation speed, revision and segmentation. In F. Alves (Ed.), *Triangulating translation: Perspectives in process oriented research* (pp. 69–95). Amsterdam/Philadelphia: John Benjamins.

Jakobsen, A. L. (2011). Tracking translators' keystrokes and eye movements with Translog. In C. Alvstad, A. Hild, & E. Tiselius (Eds.), *Methods and strategies of process research* (pp. 37–55). Amsterdam/Philadelphia: John Benjamins.

Jakobsen, A. L., & Schou, L. (1999). Translog documentation. In G. Hansen (Ed*.), Probing the process in translation: Methods and results* (pp. 151–186). Copenhagen Studies in Language 24. Copenhagen: Samfundslitteratur.

Jensen, A. (2000). *The effects of time on cognitive processes and strategies in translation.* (Unpublished Ph.D. thesis).

Just, M. A., & Carpenter, P. A. (1980). A theory of reading: From eye fixations to comprehension. *Psychological Review, 87*, 329–354.

Kapranov, A. (2013). Beginner Students' Speech Fluency in a Second Language Compared Across Two Contexts of Acquisition. In E. Piechurska-Kuciel & E. Szymańska-Czaplak (Eds.), *Language in Cognition and Affect* (pp. 81–94). Berlin, Heidelberg: Springer.

Krings, H. (1986). *Was in den Köpfen von Übersetzern vorgeht*. Tübingen: Gunter Narr.

Lacruz, I., Shreve, G. M., & Angelone, E. (2012). Average Pause Ratio as an Indicator of Cognitive Effort in Post-editing: A Case Study. *Proceedings of the AMTA 2012 Workshop on Post-editing Technology and Practice*. San Diego, CA. Available at: http://amta2012.amtaweb.org/AMTA2012Files/html/2/2_paper.pdf

Lacruz, I. & Shreve, G. M. (2014). Pauses and Cognitive Effort in Post-Editing. In S. O'Brien, L. Winther Balling, M. Carl, M. Simard, & L. Specia (Eds.), *Post-Editing of Machine Translation: Processes and Applications* (pp. 244–272). Cambridge: Cambridge Scholars Publishing.

Lörscher, W. (1991). Thinking-aloud as a method for collecting data on translation processes. In S. Tirkkonen-Condit (Ed.), *Empirical research in translation and intercultural studies* (pp. 67–77). Tübingen: Gunter Narr.

O'Brien, S. (2006). Pauses as indicators of cognitive effort in post-editing machine translation output. *Across Languages and Cultures, 7*(1), 1–21.

O'Brien, S. (2009). Eye tracking in translation process research: Methodological challenges and solutions. In I. M. Mees, F. Alves, & S. Göpferich (Eds.), *Methodology, technology and innovation in translation process research: A tribute to Arnt Lykke Jakobsen* (pp. 251–266). Copenhagen studies in language 38. Copenhagen: Samfundslitteratur.

PACTE (2005). Investigating translation competence: Conceptual and methodological issues. *Meta, 50*(2), 609–619.

Schilperoord, J. (1996). *It's about time: Temporal aspects of cognitive processes in text production*. Amsterdam: Rodopi.

Schilperoord, J. (2001). On the Cognitive Status of Pauses in Discourse Production. In G. Rijlaarsdam (Series Ed.), T. Olive, & M. Levy (vol. Eds), *Studies in Writing, vol. 10: Contemporary tools and techniques for studying writing* (pp. 61–87). Dordrecht: Kluwer Academic Publishers.

Timarová, S., Dragsted, B., & Hansen, I. G. (2011). Time lag in translation and interpreting. In C. Alvstad, A. Hild, & E. Tiselius (Eds.), *Methods and strategies of process research: Integrative approaches in translation studies* (pp. 121–146). Amsterdam/Philadelphia: John Benjamins.

Zulkifli, P. (2013). *Applying pause analysis to explore cognitive processes in the copying of sentences by second language users.* (Ph.D. thesis, University of Sussex, United Kingdom). [retrieved from: http://sro.sussex.ac.uk/45933/1/Zulkifli%2C_Putri_Afzan_Maria.pdf].