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Mind's not lazy: On multitasking in interpreters and translators

Katarzyna Stachowiak
Adam Mickiewicz University, Poznań
kstachowiak@wa.amu.edu.pl

Abstract

Multitasking while performing complex cognitive tasks is a demanding activity. Numerous studies on dual- and multi-tasks revealed that whenever two or more actions performed simultaneously require the same type of processing, the response to the concurrent stimuli is impeded or impaired (Pashler 1994; Arnell 2002; Tombu and Jolicoeur 2003; Lehle and Hübner 2008). Two main theories describing multitasking view it either as a capacity sharing or a fast-switching performance. Meanwhile, simultaneous interpreting (SI) is commonly considered to be a multi-task activity, and numerous authors have attempted to define the tasks that an interpreter has to complete in the simultaneous mode (Goldman-Eisler and Cohen 1972; Gerver 1976; Lederer 1981; Gile 1995, 2009; Seeber 2011). As a less time-constrained process, translation is rarely investigated in terms of simultaneity of actions. Yet, studies on translators prove that professionals multitask voluntarily by, for instance, reading a new part of the source text while typing the translation of a previous one, or dictating the output, similarly to what interpreters do. This behavior is frequently aimed at making the work faster (Carl et al. 2011; Dragsted and Carl 2013). The aim of this study was to examine the multitasking skills of interpreters and translators in a dual-task. The results speak in favor of translators multitasking almost at the same level as interpreters, although the source of their dual-task skills remains unknown. Section 1 of this article explains the idea of multitasking, while sections 2 and 3 focus on the nature of interpreting and translation, respectively. Finally, section 4 presents the experimental study.

1. Introduction

Multitasking is a practice of everyday life; yet, at the same time one of the most intriguing skills of human beings. Performing and supervising numerous activities at the same time has for long been a puzzlement for scientists. The actual simultaneity of actions performed in a dual-task became one of the major scientific riddles, which led to two main concurrent theories, stating either that the human mind is capable of simultaneously focusing on a number of tasks, or that simultaneous performance is in certain situations impossible and multitasking can occur due to the switches of attention, unobservable for the human eye and fast enough to create the impression that all the actions performed are constantly under the focus of attention.

Multitasking is usually thought to be an ability, a skill indispensable to accomplish certain complex tasks. It is rarely perceived as a strategy that can be consciously applied in order to facilitate one's performance. Contrary to this, observing professional translators' behaviour proves that multitasking can be a successful strategy facilitating one's job. Certain translators do multitask even when it is not needed, which makes them comparable to simultaneous interpreters who have to constantly process in parallel. Simultaneous interpreting is a unique kind of multitasking, involving concurrent language comprehension and production, self-monitoring, self-correction and many other activities. Mastering the simultaneous performance of several concurrent tasks is, irrespective of language skills, one of the most challenging, while at the same time a crucial goal for an interpreter. On the other hand, written translation does not seem to require mastering this skill, mainly due to no time constraints in rendering a given chunk of text in the target language. A translator can sequentially read and write, as well as make breaks in these activities in order to, for example, check the vocabulary or re-read a passage. However, studies on translation performance show that it does require a certain amount of parallel processing, and that many professionals do multitask, even when they do not need to, in order to facilitate their work and make it faster. It therefore seems that multitasking can also be a successful strategy facilitating written translators' job. The fact that not only simultaneous interpreters, but also translators multitask gave grounds for the experiment presented in this article. The study investigates interpreters' and translators' multitasking skills in a dual-task. Its main purpose was to verify whether translators have developed multitasking skills and whether these skills are comparable to the ones of professional interpreters.

2. Multitasking and attention division

Human functioning in every-day life is based on *multitasking*, usually understood as performing two or more actions simultaneously. In the general understanding of the term, multitasking is associated either with performing several concurrent tasks at one time, or fast switching between the tasks, in order to monitor them both, or finish them at the same time. While both simultaneous performance and switching between a number of activities are generally understood as multi-task performance, for the purpose of this work, only simultaneous actions will be taken into consideration, which means that multitasking will be treated as performing a number of actions exactly at the same time. The term *switching between tasks*, in turn, will be later used for a strategy used by the human mind to deal with simultaneous performance and it will not refer to performing a series of different tasks.

Although multitasking is commonly understood as performing a number of tasks at the same time, it is the *simultaneity* of actions that is questioned by a number of researchers. While on the level of general understanding and eye observations certain tasks may seem to be performed in parallel, there are doubts related to the fact whether in reality the human mind splits its capacity into a series of actions or switches between the tasks at a speed that is empirically unobservable. In the researchers' treatment of the dual- or multi-task performance, two main approaches can be distinguished: either multitasking is viewed as performing a series of tasks at the same time, sharing the concentration and mental capacity among them respectively to their difficulties, or, according to other theories, performing certain actions at the same time is impossible and, therefore, one action must wait until the other is completed.

A number of theories support the idea that multitasking is simultaneous performance of two or more actions. On a smaller scale, capacity-sharing models propose parallel processing of particular tasks, with the mental capacity being divided between them. The amount of this capacity may be limited, as in the model proposed by Kahneman and Tversky (1973, 1979), and this limitation can make the simultaneous performance of two tasks challenging (Kahneman and Tversky 1973). According to the capacity sharing model by Tombu and Jolicoeur (2003), the amount of attention devoted to each of the concurrent actions depends on their difficulty. At the same time, there are actions that require the same type of mental processing (for instance, programming two motor reactions). In such a situation, the mental capacity of a processor responsible for these activities needs to split between the two tasks. When the tasks are challenging, the overall performance is impeded, as only half of the capacity is devoted to one task. Figure 1 presents several scenarios of sharing the mental capacity between the actions.

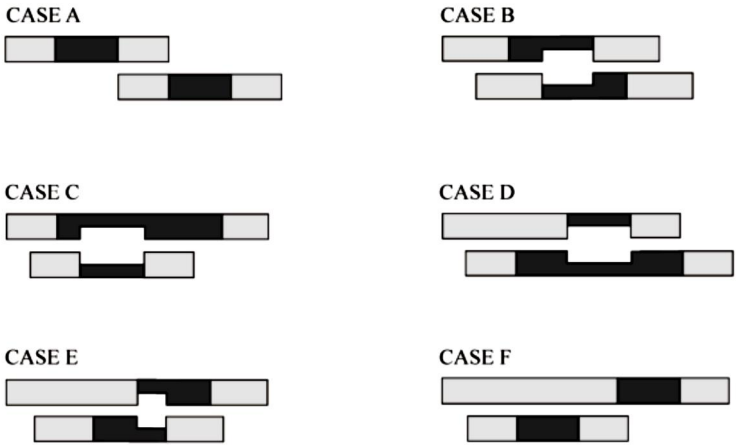

Figure 1: Several capacity sharing scenarios (after Tombu and Jolicoeur 2003).

Although Tombu and Jolicoeur (2003) argue that the mental capacity can be shared, they also specify when there is a need for it to split. Figure 1 illustrates that there are certain actions (marked black) that require the same type of processing (thus, a split capacity), while other activities can be performed in parallel without any interference (marked grey). As the scenarios show, the possible interference depends on which tasks overlap with each other and how they overlap. For instance, let us assume that one needs to ask for water why playing chess. He or she needs to programme two motor reactions: of the lips and of the hand, but planning a move in chess needs much more visual stimuli and perceptual attention than asking for water. Therefore, programming the hand move occurs after programming the motor reaction of the lips, even if in general the two activities were started at the same time. Even though there are two tasks conducted in parallel, two programming stages do not overlap and there is no interference in general (a very similar scenario is presented in Case F, in Figure 1). Stating that there are actions which do interfere with one another and those which do not is, in fact, the basis of the fast-switching approach to multitasking.

In the fast-switching approach, the presumption is that the human mind switches very quickly between tasks that have to be both carried out at a certain time. This, in turn, is caused by the fact that actions requiring the same type of processing cannot be performed exactly simultaneously. As Arnell (2002: 497) put it, "there is often strong interference if a second target stimulus (…) is presented before processing of a prior target stimulus (…) is complete". This refers to the psychological *bottleneck theory*, stating, in a very general sense, that two or more tasks requiring the same type of mental processing cannot be performed simultaneously, because the specific mental tool or processor needed to operate

for both actions is able to work for only one at a time. Therefore, whenever the need for processing two such tasks occurs at the same, or nearly the same time, one action has to wait until the other is completed. In the light of bottleneck theory (Broadbent 1957; Pashler 1994), it has been frequently disputed which actions interfere with one another, that is require the same type of processing, generating a bottleneck in processing, and which do not. Pashler et al. (2008) supported the idea that stimulus identification and response selection or decision-making are subject to bottlenecks and that they can interfere with one another as well. Thus, not only identifying two stimuli, but also stimulus identification and, for example, response selection cannot be performed in parallel. On the other hand, perception and production have been proved not to produce a bottleneck effect (e.g. Pashler 1994).

More recently, an idea of a common attentional bottleneck has emerged. As Tombu et al. (2011: 1) state, "human information processing is characterized by bottlenecks that constrain throughput. These bottlenecks limit both what we can perceive and what we can act on in multitask settings. Although perceptual and response limitations are often attributed to independent information processing bottlenecks, it has recently been suggested that a common attentional limitation may be responsible for both". A typical model of a bottleneck is presented in Figure 2. In the model, it was assumed that stages A, B, C of the first task interfere with stages A, B, C of the second task, respectively, and cannot be performed simultaneously. As shown in the figure, the inability to process certain stages in parallel results in a longer reaction time to one of the stimuli.

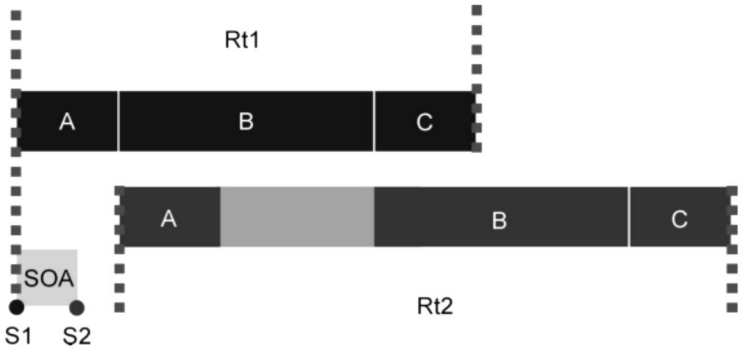

Figure 2: Bottleneck model, with stage A and the central stage (B) impeded (based on Pashler 1994). (S1 and S2 stand for the first and second stimulus respectively, while RT1 and RT2 for the reaction times; SOA stands for stimulus onset asynchrony, that is the interval between two stimuli).

According to the bottleneck theory, certain actions cannot be processes simultaneously and one of them has to wait before it is processed. Consequently,

the reaction to one of the stimuli is postponed. If no strategy was applied to compensate for the delay, the inability to process in parallel would result in a slower performance in general. However, in order to recoup the loss of time, the human attention switches from one task to another with high frequency. Due to this, one's overall performance is not impeded even when there are concurrent tasks that cannot be processed in parallel (and even if the impediment is visible on a smaller scale).

Depending on the choice of the specific theory (i.e. fast-switching vs. capacity-sharing), one should be either characterised by large mental capacity or good fast-switching skills in order to be successful in multi-task performance. However, the aim of this paper is not to speak in favour of one of the theories, but, rather, to investigate multitasking skills in interpreters and translators.

3. Multitasking in simultaneous interpreting

Simultaneous interpreting (SI) is an activity based on multitasking. The very idea of this kind of interpreting (as opposed to consecutive interpreting) is transforming a meaning from the source language (SL) into the target language (TL) with a latency that would not leave the TL listener behind the course of action. This means that there has to be as little delay between the SL and TL as possible. An interpreter has thus to speak in the TL and listen to a new piece of information in the SL at the same time, in order not to make the audience wait for the message. Rendering this message in the TL and listening to the SL are not the only activities SI includes. Apart from merely listening and speaking, an interpreter needs to monitor himself or herself, compare the meaning with the previously gained and general knowledge, and, quite often, correct their own mistakes, read the speaker's slides when available, as well as check the vocabulary or communicate with the passive interpreter (a boothmate who is not actively interpreting at the moment, but helping his or her partner). Gile (1995) has named all these activities *efforts* which interpreters have to make. During an interpretation, as Gile suggests, each effort has to be given an equal amount of attention as otherwise one of the actions is impaired. The efforts he describes are:

- *listening and analysis* (L), consisting of "all the mental operations between perception of a discourse by auditory mechanisms and the moment at which the interpreter either assigns, or decides not to assign, a meaning (or several meanings) to the segment which he has heard" (2009: 160);
- *production* (P), consisting of "all the mental operations between the moment at which the interpreter decides to convey a datum or an idea and the moment at which he articulates (overtly produces) the form he has prepared to do so" (2009: 163);

- *short-term memory* (M), consisting of "all the mental operations related to storage in memory of heard segments of discourse until either their restitution in the target language, their loss if they vanish from memory, or a decision by the interpreter not to interpret them" (2009: 165).

Additionally, Gile (2009: 166) describes *coordination effort* (C), needed to control the overall performance. Whenever the three main actions are to be carried out simultaneously in the process of simultaneous interpreting, the mental capacity, as Gile postulated, needs to be divided into the sub-tasks adequately so that each of the actions can be performed without impediment or without errors.

It was stated above that whenever two actions requiring the same type of processing are performed at the same time, there is a likelihood of the performance being impeded or impaired, unless the person that performs the two actions has large working memory capacity (according to capacity sharing theory) or is extremely skilled at fast switching (according to fast-switching theory). It has also been pointed out that stimulus identification and response selection or decision-making may interfere with each other (contrary to perception and production). If we take a closer look at the process of listening and speaking in SI, we can observe that these stimulus identification and response selection stages often overlap. While interpreting, an interpreter goes sequentially thorough the following actions:

> perception (listening) → stimulus identification (SL language processing) → response selection (TL language processing) → production (speaking).

Despite this sequential order, due to time constraints, a response selection related to one piece of information is frequently processed simultaneously with, for example, identifying a new stimulus. Defining the process of understanding the SL meaning as *stimulus identification* and the process of choosing an equivalent in the TL as *response selection* is a simplification; however, it illustrates well what multitasking is in SI on a smaller scale. In fact, the processes of listening and speaking are much more complex. Lederer (1981: 115), for instance, distinguishes three different stages of understanding the SL meaning by an interpreter: *sound and word identification*, *parsing*, and *synthesis with the previous knowledge*. The third component is of particular importance, according to Lederer, as it reflects the cognitive analysis of the input. It is possible that all these sub-stages of stimulus identification (and response selection) interfere with one another in various ways in SI. Nevertheless, they will be treated in this paper generally as identifying the input and preparing the output.

Input and output, according to Gerver's (1969) SI model, go through two distinct mental buffers. A piece of information can be processed whenever the

proper buffer is 'unoccupied'. If the buffer is full, the piece of information needs to wait until the previous one is processed (which reflects the bottleneck theory described in section 1). In 1969, Gerver published his study revealing that whenever the speaker's delivery is faster than 100-200 words per minute, the interpreter's performance declines significantly (Gerver 1969). A similar research project was conducted by Le Ny (1970), who argued that it is rather the rate of new information coming that plays the key role in the interpreter's understanding and, consequently, rendering the message. The results of these experiments reflect to some extent the difficulty in multitasking in SI. The faster the speech, the more particular stages of SI overlap (and the quicker the process of conveying a meaning from SL to TL needs to be).

Seeber (2011) also analysed the interference between overlapping SI components. Having analysed the average time of speech understanding (which Seeber claims to be 200 ms in context) as well as errors and coping strategies of simultaneous interpreters, he stated that there are certain 'conflicts' between concurrent actions in SI. These conflicts occur whenever two similar actions (e.g. two cognitive tasks) overlap in interpretation (and they usually do overlap, due to time constraints). Seeber observed that there are various techniques used by professional interpreters to make their rendering more fluent or logical and the usefulness of these techniques speaks in favor of a certain difficulty related to multitasking in SI (Seeber 2011).

In fact, it is the ability to multitask that is supposed to distinguish interpreters from bilinguals and monolinguals. While bilinguals are frequently engaged in interpreting-related tasks, and their daily routine includes switching from one language to another, they have been reported to have worse executive control, which is responsible for attention management and focus in multitasking. While bilinguals and multilinguals outperform monolinguals in terms of executive control (Carlson and Meltzoff 2008; Colzato et al. 2008) and cognitive processing (Paolin-Dubois 2010), trained interpreters are in turn proved to score better than all these groups. Köpke and Nespoulous (2006) found a working memory advantage in interpreters when compared to bi- and monolinguals, while Christoffels, de Groot and Kroll (2006) showed that interpreters have better memory than bilinguals. Finallly, Yudes, Macizo and Bajo (2011) compared interpreters to bilinguals and monolinguals, and found that interpreters outperform the other two groups in terms of executive control.

The ability to multitask successfully in SI is learnt with time. Interpreters' training programs usually slowly introduce SI to the novices. An SI course often starts with the so-called introduction to simultaneous interpreting and teachers begin their classes with shadowing (repeating the message in the same language, in the simultaneous mode) rather than SI itself. The pace of the SL text

delivered to students at the beginning is usually significantly slower than in real life, as multitasking is thought to be an ability that trainees need to acquire with time. Once mastered, multitasking proves to be a useful skill. The question remains whether those who do not have to develop it find it equally helpful. The general understanding of multitasking in interpreting is that it needs to be learnt in order for an interpreter to do his or her job. However, the next the section is going discuss multitasking also as a strategy, often applied by translators who, theoretically, do not need to do two things at one time.

4. Multitasking in translation

Written translation is an activity of transforming a written SL text into a written TL one. As Catford (1965: 20) puts it, "translation is the replacement of textual material in one language (SL) by equivalent textual material in another language (TL)". Functionalists, in turn, think of translation as "the production of a functional target text maintaining a relationship with a given source text that is specified according to the intended or demanded function of the target text" (Nord 2007, cited in Shutttleworth and Cowie 2007: 182). Finally, Koller (1995) described translation as a product of text-processing, while at the same time pointing to the process that occurs between the source and target text. As he writes (1995: 196),

> Translation can be understood as the result of a text-processing activity, by means of which a source-language text is transposed into a target-language text. Between the resulting text in L2 (the target-language text) and the source text L1 (the source language text) there exists a relationship (...).

As the target text is delivered to the reader once the translation is finished, there is no time pressure related to the audience waiting for a specific chunk of the text. The only kind of time pressure is the one related to the deadline, which does not force multitasking (but may force translators to seek strategies that would speed up their performance). In other words, the SL-TL latency does not play a significant role in this type of translation. Therefore, there is no need to multitask in order to minimize the SL-TL span. The TL text may be produced after a SL text is processed, not in parallel to it. A translator may sequentially read, translate and write, or, in other words:

- fixate on the SL text (SL perception stage, corresponding to sound perception in simultaneous interpretation);
- process the SL text (SL stimulus identification);
- make the decision about what to write (TL response selection);

- write (usually type) the text in TL (TL production, corresponding to speaking in simultaneous interpreting).

As shown above, the activities of translation and interpreting are in fact very similar. Each requires going through the stages enumerated in Table 1. The stages, however, are, again, a simplification. Similarly to interpreting, translation is a much more complex activity than the table suggests. The comparison made above is rather intended to illustrate that the stages of transforming a SL meaning into a TL one are common for interpreting and translation (with the actual transformation of meaning occurring somewhere between stage 2 and 3). It is the dynamics of SI that makes these stages overlap to a great extent and, therefore, multitasking is easy to observe in interpreting.

STAGE	SIMULTANEOUS INTERPRETING	WRITTEN TRANSLATION
1.PERCEPTION	(MOST FREQUENTLY) AUDITORY PERCEPTION (HEARING/LISTENING)	VISUAL PERCEPTION (SEEING/READING)
2.STIMULUS IDENTIFICATION	SL PROCESSING	
3.RESPONSE SELECTION/DECISION MAKING	TL PROCESSING	
PRODUCTION	SPEAKING	(MOST FREQUENTLY) TYPING

Table 1: Corresponding stages in simultaneous interpreting and translation.

Since multitasking is considered to be a challenging activity (see section 1), one should avoid it when it is not necessary. Numerous researchers (e.g. Weber 2006; Gladwell 2007) claim that the mind is lazy and focused on minimizing superfluous effort, 'shutting down' senses that are not essential for accomplishing a given task, in order to function successfully. Following that reasoning, a translation process should resemble a sequence of the following activities: first, fixating on a text, then identifying the stimulus and making the decision about the TL equivalent and, finally, typing.

On the other hand, some professional translators often choose to work with a speech recorder: they read the SL text and dictate the TL one, which is very similar to the so-called *a vista interpreting* or *sight translation* (interpreting from a written text), and resembles simultaneous interpretation. This means that there are individuals who voluntarily choose a theoretically more difficult way of translating: the one that involves multitasking. Similarly, in a study involving eye-tracking and key-logging, Carl et al. (2011) observed that professionals who do not need to look at the keyboard when typing look far ahead the SL text while typing a target text that corresponds to the source text's previously fixated fragment. Moreover, they found that translators, in general, tend to look

slightly ahead of the text that is currently translated (Carl et al. 2011; Dragsted and Carl 2013). As Carl et al. (2011: 134) pointed out:

> The average look-ahead for our translators was around four words (…) Most ST fixations were in the area between 2 and 6 words to the right of the word being translated. (…) A certain amount of forward planning is a general feature of the translation process. This does not imply that the translators never look at a ST word simultaneously with producing an equivalent in the TL, but all translators had most fixations to the right of the word being translated.

Looking ahead of the text (that is, looking at a SL text that occurs after, and is not an equivalent to a TL text that is being typed) indicates that a certain amount of information is decoded while new information is being encoded.

What is more, just like interpreting, written translation is not only composed of the four stages listed in Table 1, from perception to production. Séguinot (1989: 78) states that "when we translate, we are actually performing a number of tasks at the same time. We monitor our output and tend to correct mechanical errors as they occur". Similarly to SI, translation includes coordination, monitoring, self-correction, synthesis with the previously gained and general knowledge, as well as cooperation: not with another interpreter, but with translation aids and dictionaries. According to Whyatt (2012), for each new task translators create the so-called *knowledge integration network* (KIN) which integrates all the cognitive resources and abilities needed for fluent and successful translation. As she stated, one's bilingual knowledge is constantly embedded within one's general knowledge structures during translation. The ability to successfully synchronize all the abilities related to translation is what differs an expert from a novice. As Whyatt writes, "the human ability to translate in order to reach the level of expertise has to involve the ability to integrate knowledge needed to perform each and every task" (2012: 203-204). Importantly, this integration enables a translator to conduct several actions in parallel (e.g. monitor the output on the screen and retrieve an item from the long-term memory). Translation, as Séguinot (1989) argues, is not a truly sequential behavior, as translators never wait for one action to be completed before another and choose to multitask instead. The cost of this multitasking is visible in translation errors: the ones stemming from erroneous motor reactions, or mistakes related to the limitations of working memory, or the cooperation between long-term memory and the short-term store.

A certain degree of multitasking is visible even in text copying. John (1999) has named three processors involved in this activity: *perceptual operator* (fixating on a text), *cognitive operator* (identifying the stimulus and retrieving the

spelling from the long-term memory, as well as initiating typing) and *motor operator* (hitting the correct key while typing). The activities of these three processors, as John suggests, can overlap. The same researcher also assumes that the perceptual operator stays approximately three words ahead of the cognitive one, even during fluent typing (John 1999). This, again, means that identifying a given symbol proceeds concurrently with initiating the typing of another one. Experimental findings demonstrate that certain translators do choose simultaneous, rather than sequential, performance. This indicates that multitasking can be used as a strategy in conducting certain actions, and that some individuals may perceive it as a facilitation, not an obstacle, while working. The question is how developed translators' multitasking skills are, especially in comparison to those of simultaneous interpreters. The study presented below investigates these skills in both groups.

5. The experimental study

The following sub-sections present a study investigating dual-task performance in interpreters, translators and, additionally, late bilinguals (as a control group). The study does not investigate the subjects' behavior while actually interpreting or translating, as these two activities are hard to compare, and designing either an interpreting or a translation exercise would mean that the experiment is oriented towards one group more than the other. Therefore, I decided to test the participants in an experiment that would investigate their multi-task performance, attention management and executive control rather than interpreting or translation skills (therefore, the task does not resemble interpreting, nor translation). For this purpose, I used a simple linguistic dual-task: the subjects were asked to repeat 'blah, blah, blah' while deciding whether two words are synonyms. The usefulness of similar experiments in testing the multi-task performance was underlined by, for example, Baddeley (2010), who used the so-called 'in-bag' exercise (i.e. saying 'blah, blah, blah' or saying letters/numbers in a sequence) while making his subject perform another linguistic task. In my study (even though I avoided interpreting and translation exercises), one of the tasks consisted in deciding about the synonymy of two English words, as I aimed at making the subjects perform an activity that would require the comparison of the words' meanings. In other words, the task resembles paraphrasing, which is considered by a number of researchers (e.g. Jakobson 1969; Snell-Hornby 2006; Zethsen 2009) to be a type of translation (intra-lingual translation). The following sub-sections describe the study in detail.

5.1. The specific aim of the study

The purpose of the present study was to investigate the performance of professional translators (PT) and professional interpreters (PI) in a dual-task. In other words, the experiment aimed at verifying whether PTs would be equally skilled at multitasking as PIs. The secondary aim was to compare the interpreters and translators with a control group of late bilinguals. More specifically, the study tested whether one of two concurrent tasks would be impaired or impeded.

5.2. Participants

The study involved three groups of participants: 5 non-translating professional interpreters (having 3-14 years of experience), 6 non-interpreting professional translators (having 5-28 years of experience) and a control group of 6 late bilinguals (who learned English after the critical learning period, but used it with near-native proficiency), who neither translated nor interpreted. There were 3 females and 2 males within the PI group, 2 females and 4 men among PTs and 3 females and 3 men in the control group (LBs). All the participants had English as their second language. One PT and one LB were left-handed, while the rest of the participants were right-handed. The subjects had normal and corrected-to-normal vision. They were not screened for any other known disabilities. As the groups of interpreters and translators were not homogeneous in terms of years of experience, I decided to analyze the subjects who work with comparable intensity. All the PIs' and PTs' reported interpreting or translating (respectively) at least 80 hours in a month. Additionally, only those PTs who stated that they type without looking at the keyboard took part in the study.

5.3. Materials and apparatus

There were 220 English abstract and non-abstract nouns used. Their rounded frequency per million word tokens ranged from 36 to 76 (according to the *British National Corpus*). E-Prime 2.0 (software used for computerized experiment design, data collection and analysis, used mainly in studies that require precise timing features) was the program used to display the stimuli and measure the reaction times. All the trials were performed by means of a Toshiba Satellite laptop with an in-built sound recorder which was used to record the participants' performance.

5.4. Procedure

The participants were asked to say 'blah, blah, blah' repeatedly (task 1). While doing so, they were presented with a pair of words on the screen (preceded by a white screen with a centering cross), written in Arial 24. The length of the words was controlled: each visual stimulus was presented within the parafovea (max. 10º from the fovea). The words were either synonyms or had a different meaning (but were not antonyms). The participants were asked to give a speedy decision (task 2) whether the words are synonyms or not, by pressing '0' for 'no' or '1' for 'yes' on the keyboard ('0' and '1' as 'yes' and 'no' were counterbalanced; half of the participants were pressing '1' for 'no' and '0' for 'yes'). Once a participant pressed one of the keys, the centering cross appeared and after 3000 ms another pair of words was displayed. The subjects were told that it was equally important to give a speeded response and to keep saying 'blah, blah, blah' without interruption. The experiment proper was preceded by a testing session, during which the participants needed to achieve 85% of correctness in deciding about the synonymy of words. Apart from the dual-task, the participants were asked to perform a single one (task 0). Task 0 was identical to the previously mentioned task 2; however, it was conducted with no concurrent activities. This exercise was designed to measure the mean RTs in three groups when the subjects were not multitasking.

5.5. Variables and statistical analysis

Group affiliation (i.e. interpreter, translator, late bilingual) was the main independent variable. Years of experience was another one. The dependent variable was the reaction time (RT) to the visual stimulus (pair of words, task 2). Additionally, the speech rate during task 1 was measured. Repeated measures ANOVA was performed for statistical analysis.

5.6. Hypotheses

Three hypotheses were formulated for the study, namely:

- Hypothesis 1: Both interpreters and translators will have shorter reaction times than late bilinguals.
- Hypothesis 2: There will be little, not statistically significant, difference between the mean reaction times if interpreters and translators.
- Hypothesis 3: The longer the experience in a given profession (interpreter/translator) the shorter the individual mean reaction time.

5.7. Results

The results showed that both professional interpreters and professional translators surpassed late bilinguals when it comes to the reaction times (the difference reached statistical significance, $p < 0.001$), which confirms Hypothesis 1. On the other hand, there was little difference between the RTs of PIs and PTs. Nevertheless, the difference was statistically significant ($p < 0.001$), which means that Hypothesis 2 was only partially corroborated. Figure 3 presents the mean reaction times (RTs), for the three groups. Hypothesis 3 was not corroborated. There were no significant differences within the groups themselves, related to the years of experience (which may be due to the fact that all the interpreters and translators were practicing on a daily basis). One late bilingual was excluded from the analysis due to his poor performance on task 1. His speech rate while saying 'blah, blah, blah' was below 70 words/min. with unequal pauses. The mean speech rate in the group of interpreters was 182 words/min. (SD = 11), while in the group of translators it amounted to 157 words/min. (SD = 26). Late bilinguals spoke at a rate of 123 words/min. (SD = 21). The inter-group differences reached statistical significance for task 1 ($p < 0.001$ in all cases).

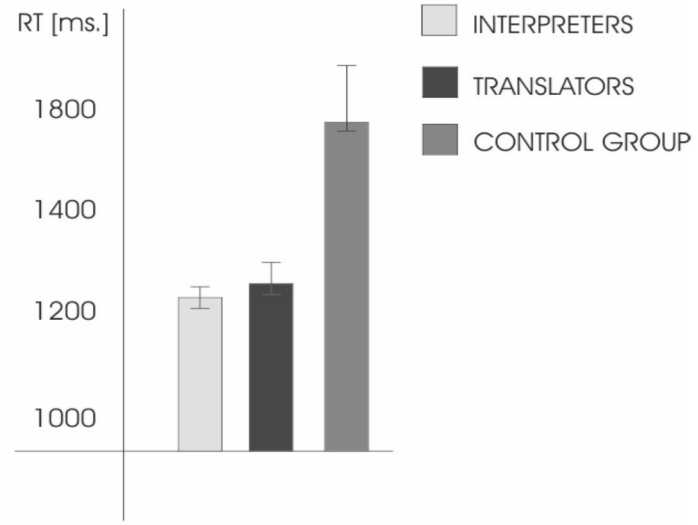

Figure 3: Mean reaction times (RTs) in the experimental and control groups.

The mean reaction times in the single task (task 0) were as follows: 1120 ms in the group of interpreters (SD = 211 ms), 1078 in the group of translators (SD = 98 ms), and 1310 among late bilinguals (SD = 157 ms). Only the difference between LBs

and the other two groups reached statistical significance ($p < 0.001$). No effect related to the sex of the participants, or their handedness, was observed.

Task 2 (judging synonymy) demonstrated that translators are almost as successful as interpreters. While interpreters performed slightly better in this task (they had smaller RTs), the difference between PIs and PTs was not statistically significant. On the other hand, late bilinguals were shown to have longer RTs, which accounts for poorer dual-task performance. Results speaking in favor of translators successfully multitasking were also obtained by Carl et al. (2011). The fact that interpreters and translators performed similarly in terms of RTs, though they were significantly better than late bilinguals, may be explained in different ways. First, it is possible that professional translators developed multitasking as a strategy that facilitates their performance and makes it faster. This, in turn, would indicate that multitasking may be a strategy naturally implemented by the mind while conducting certain actions. De Neys et al. (2013) stated, contrary to the popular belief, that humans do not always select the simplest way to accomplish a task, in order to minimize their effort, but are more confident when choosing sophisticated solutions. Taub et al. (1994), advocated the so-called 'learned non-use': observing partially paralyzed patients, he noticed that whenever the cost of learning how to use the injured part of the body again was higher than teaching another healthy part (e.g. the other hand) to take over its tasks, the brain was lazy enough not to 'invest' in rehabilitating the paralyzed one and would rather 'teach' a healthy body part how to multitask. Similarly, as Taub et al. (1994) stated, the mind is constantly judging what to learn in order to be more effective. These and other findings suggest that multitasking maybe a strategy that the human mind simply perceives as worth applying in translation. When working in a sequential way proves not to be efficient enough or when a certain level of automaticity is reached for sequential translating, the mind might 'invest' in a more complex behavior in order to improve its functioning in a long-term perspective.

Next, translation might require a certain dose of multitasking itself (that is, multitasking may not be a strategy, but, in fact, a necessity in translation). Multi-task performance in this case has not been investigated by researchers to the same extent as in interpreting. However, a translator needs, in fact, to concurrently hold a certain dose of information (e.g. sentence context) in his or her working memory and make the decision about what to type at a particular moment, even if he or she is not reading ahead. It is possible that concurrent processing and writing develops multitasking skills themselves, and that these skills later evolve into an ability to simultaneously read, process (and translate) and write. For instance, the PACTE research group (PACTE 2000) proposed a definition of translation competence that includes strategic thinking. This strategic

planning is needed to integrate new chunks of text with the preceding ones and is used in the course of translation. PACTE does not comment on multitasking extensively, but states that such strategic thinking occurs in parallel with translating new parts of text. Moreover, translation competence involving this skill distinguishes experts from novices (PACTE 2000; Séguinot 1990), which indicates that translators might develop their multitasking skills over time.

Finally, translators' proficiency in multitasking may be justified by them being naturally talented in this domain. It is possible that certain people have a gift for multitasking and that these individuals often choose translation or interpreting as their career. Importantly, translators often admit that they did not decide to become conference interpreters mainly because of excessive stress related to this profession (Kurz 2003). It is frequently stated that psychological features are as important for an interpreter as intellectual ones. Bontempo and Napier (2011) even talk about mental stability as an indicator of a future interpreter's competence and professional success. This indicates that some translators might be, intellectually, equally skilled for interpreting as those who actually choose to be simultaneous interpreters. The fact that late bilinguals performed much worse than the other two groups confirms that multitasking skills are common for interpreters and translators; however, it does not explain the source of this phenomenon. There is a need for subsequent studies testing multitasking skills in larger groups, as well as in both groups before and after their professional education.

When it comes to task 1, interpreters were speaking at the fastest rate, leaving both translators and late bilinguals behind (while PTs were, in turn, faster than LBs). Maintaining a fast speech rate while performing another task may speak in favor of better multitasking skills. On the other hand, interpreters might be more used to monitoring speaking than the representatives of the other groups. It is probable that speech production became automatic for interpreters and they had to put less effort into programming and controlling speech at a fast rate. However, following that reasoning, translators should read or type faster. If this was the case, the fast reading skills would have been reflected in the single task (task 0), where only the reaction time to task 2 was measured. As this was not the case, it can be argued that dual-task performance requires multitasking skills to a greater extent than any other (such as reading or speaking). Moreover, translators proved to perform faster that late bilinguals, and this suggests that the difficulty of conducting a dual-task was to some extent reflected in task 1. Late bilinguals had major problems both in making a speeded decision and in maintaining a high speech rate, which probably reflects their difficulties in multitasking in general.

5.8. Limitations of the study

The study was conducted on a relatively small sample. Further experiments on larger populations may lead to a more detailed profile of multitasking skills in interpreters and translators although the problem of having rather small populations of subjects seems to be present in the majority of interpreting studies. What is more, the tasks used to test dual-task skills in the three groups do not resemble the activity of either interpreting or translation. They were used in this study to verify the interpreters' and translators' performance in a dual-task, which is most likely related to their executive skills in general.

6. Conclusion

All in all, the dual-task used in the study presented in this paper provided evidence that professional translators multitask better than late bilinguals who do not translate or interpret. The translators' results were comparable to those of interpreters, although translators maintained a slower speech rate in task 1 than professional interpreters, despite the PIs and PTs having almost equal reaction times in task 2. While results of the experiment speak in favor of translators' multitasking, they do not explain why PTs developed such dual-task skills. Multi-task performance in translation needs to be investigated in detail in subsequent studies. Understanding how translators multitask can produce numerous benefits. First, it may facilitate the creation of translation aids (programs and tools). Investigating multitasking in translation also has its educational value, as it can lead to better recruitment procedures for future translators and enhance their subsequent training. Finally, translation and interpreting may facilitate understanding the way humans multitask, and the strategies used by the mind to work more efficiently.

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