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Investigating the ergonomics of a technologized translation workplace

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The modern translation workplace is characterized by intensive human-computer interaction and heavy use of language technology. In such settings, translators are subject to temporal and spatial constraints that can be mitigated or accentuated by good and poor ergonomic design, respectively. In the research reported here, an ergonomic framework encompassing physical, cognitive, and organizational aspects of the workplace has been used to gain insights into the situated activity of translation. The multi-method approach includes screen and video recordings, interviews, and ergonomic assessments at the workplace. The results of a case from our corpus suggest that apparently minor disturbances can have a negative effect on the efficiency of the translation process and potentially impact job satisfaction and even health.

Keywords: ergonomics; human-computer interaction; language technology; professional translation; situated activity; translation process

1. Introduction

In recent years, translation studies has shown a growing interest in translation as a system that involves not only multiple agents but also human-computer interactions. The reality of professional translation in knowledge economies in the so-called digital age is that translators are embedded in a complex, interlinked system that requires intensive human-machine interaction and highly technologized workplaces. Not only are translators expected to engage in the challenging cognitive activity of understanding specialized texts in one language while formulating their content in another, they must also juggle the temporal, economic, and quality demands of their employers, commissioners, clients, colleagues, and target audiences. Ideally, language technology facilitates their translation processes and

contributes to optimizing performance, but sometimes certain features might actually disturb the process, impeding productivity and limiting creativity.

We argue that viewing professional translation from an ergonomic perspective can provide an appropriate framework to understand the potential impact of various factors (cf. Lavault-Olléon 2011). Like many other knowledge workers, professional translators spend much of their day thinking and producing text at a computer. If the flow of information or level of concentration is impaired due to non-optimal workplace ergonomics, then the efficiency of the process can be compromised and the quality of the final product can suffer. Interruptions, delayed computer responsiveness, inappropriate font size, overuse of the mouse, uncomfortable chairs, and complicated procedures are just a few examples of ergonomically-related factors that can disturb the process and contribute to cognitive load and stress. Despite high levels of competence, professionals may have to exert an inordinate effort to perform at the expected level, with potentially detrimental consequences for their health and job satisfaction (cf. Eurofound 2012).

In the research described here, disturbances and interruptions that might impinge on the work of a professional translator are analyzed in detail. Before we explain our multi-method approach, we discuss how the ergonomics of professional translation are related to physical aspects of the workplace, human-computer interfaces, or workplace conditions.

2. The ergonomics of professional translation

As has been argued elsewhere (e.g., Pym 2011; O'Brien 2012), recent technological developments have dramatically altered work in practically all domains of human endeavor, including translation. Computer workplaces with a wide range of digital resources have become absolutely essential to professional translators: not only are most contemporary translations produced on screen, many are transmitted to their audiences solely in electronic form and printed on-demand, if at all. Despite its obvious importance, the impact of the physical conditions of the translation workplace, including language technology, on the cognitive aspects of the process is still relatively under-researched.

The ability to use technology effectively is an important aspect of current translation competence models and descriptions of professional profiles (e.g., PACTE 2003; Gouadec 2007/2010; Göpferich 2009). Recently, systematic cognitive research has started to focus on how this ability develops, how it can be fostered, and what impact today's technologies, tools, and information resources have on the workplace processes and practices of translators (cf. Christensen 2011).

Certain developments in translation studies reflect an appreciation of translation as a system that involves human-computer interactions and the situated nature of translation. For example, Göpferich's (2009) model is explicit about translation being embedded in contextual factors such as external information sources, working conditions, societal norms, and psycho-physical disposition. And Risku (2002; 2010; 2014) has convincingly demonstrated that a situated cognition perspective can account for the special role of context and tools to explain their impact on the translation process within a particular setting. Ergonomics provides a framework for the complexity of the situated activity of professional translation.

2.1 Physical ergonomics and professional translation

Professional translators spend long hours sitting at computer workstations, keying in text, scrolling through electronic documents, and searching for information on the web and within internal databanks. Entering text and using touchpads or computer mice are activities which involve the whole body, and not just the hands or lower arms; constant repetition of movement can cause an overload on muscles of the upper extremities and back. Physical work environment factors, such as the design of desks, office chairs, keyboards, and mice, as well as contextual factors, such as ambient noise, changes in noise levels, inadequate lighting, and sub-optimal temperature, can also influence the performance of computer workers such as translators (see Salvendy 2012 for a general overview).

In the case of professional translation, indicators of poor physical workplace ergonomics related to keyboarding and mouse activities include hand and wrist tendonitis, Carpal Tunnel Syndrome, and Cubital Tunnel Syndrome (cf. de León 2004; Lavault-Olléon 2011). Pineau (2011) offers some explanations of why these problems occur so frequently: the arrangement of letters and other keys on keyboards is not based on ergonomic considerations; and non-physiological movements are needed to type (such as hand distortions, overly frequent finger extension and imbalances between the use of the right hand and the use of the left hand). With the increasing use of CAT tools and keyboard shortcuts, the risk of repetitive strain injury might become a serious issue for some translators. Other problems include stiffness in the neck or back, and leg pain due to extended periods sitting in one position. Eyestrain due to long hours peering at a computer monitor can cause vision problems, known as Computer Vision Syndrome (cf. Rosenfield 2011).

2.2 Cognitive ergonomics and professional translation

The term ‘cognitive ergonomics’, generally associated with the domain of engineering, refers to the design, organization, and operation of user interfaces. The assumption is that if interfaces are ergonomically designed and in alignment with natural cognitive processes then they will be easier to use, fewer errors will be made, and more efficient performance can be expected (e.g., Norros and Savioja 2007). As the European standard EN15038-2006 and the international norm for translation services ISO 17100-2015 make clear, professional translators are expected to have the skills to work with language technology tools and information resources since, at highly-technologized workplaces, translating demands a sophisticated degree of computer and information literacy.

The International Ergonomics Association (IEA) describes ‘cognitive ergonomics’ as being concerned with “mental processes, such as perception, memory, reasoning, and motor response, as they affect interactions among humans and other elements of a system.”¹ Language technology such as translation memory (TM) is meant to lighten translators’ mental load (cf. Muñoz 2012; 2014) by serving as an external store of translated segments, by relieving translators of repetitive tasks, and by ensuring consistent terminology. However, research involving various language versions suggests that the use of TM tools can also negatively influence the cohesion of target texts, judgments about best choices, and likelihood of translating sentence by sentence instead of treating the text as the unit of analysis, which may increase the effort involved in revision (cf. Bowker 2005; Dragsted 2006; Torres-Hostench et al. 2010; Ehrensberger-Dow and Massey 2014).

Potential cognitive-ergonomic issues extend beyond the application of language technology tools, though. In her longitudinal investigation of sources of disturbances in translation processes, Hansen (2006) identifies various profile, product, and process parameters associated with translation. Those related to cognitive ergonomics include working conditions, time management, use of translation aids, and emotions (e.g., Beale and Peter 2008). For example, Szameitat et al. (2009) report that delays in computer responsiveness can result in lower task performance and negative emotions that might contribute to stress levels. In an investigation of attentional processes during translation, Muñoz (2009) suggests that typing mistakes might be an indication of stress and cognitive effort rather than simply the result of inappropriate physical actions. Such mistakes also affect the cognitive process, since the translator has to backtrack to correct them.

1. <http://www.iea.cc/whats/index.html>

2.3 Organizational ergonomics and professional translation

As a situated activity, the demands of professional translation differ depending on the physical setting, the task demands, the usability of tools, and the system within which the translator works. In IEA's terms, the last-mentioned is covered by organizational ergonomics, which "is concerned with the optimization of sociotechnical systems, including their organizational structures, policies, and processes." This may be obvious in the case of staff translators working for language service providers or institutions, but freelancers are also part of a system of 'translational action' (cf. Holz-Mänttari 1984). Risku (2014) notes that even the smallest dyad of a freelance translator working for a single client-author can be better understood as a system of complex networks.

Introducing language technology to professional translation workplaces may have resulted in too much focus on technical aspects and too few on the social implications, with a consequent disorientation on the part of the users. Doherty and King (2005:2), for example, have pointed out that "[s]ystems development projects have typically been viewed as exercises in technical change, rather than socio-technical change", with Olohan (2011:345) adding that "the human and organizational aspects are not addressed at all, or only implicitly, or in an ad-hoc fashion, when the system is being developed." Research has also shown that client-related tools and resources seem to be constraining the translators' autonomy, since even apparently low-level decisions have to be checked against what has already been documented in style guides, parallel texts, websites, concordances, bilingual dictionaries, forums, and translation memories (e.g., Massey and Ehrensberger-Dow 2011; Ehrensberger-Dow and Massey 2014). If an organization does not allow the translators the freedom to make decisions at a micro textual level, then it is unlikely that they will have much choice in the workflow or planning of their tasks. This could have serious implications for their self-concept, professional identity, and job satisfaction as well as possibly negative consequences for their performance and health. In the following section, we explain how we have started investigating these interactions.

3. Studying the ergonomics of technologized translation

The technologization of the professional translation workplace has resulted in translation studies reaching out to other disciplines, whether to contribute to the development of computer-aided translation tools and machine translation or to understand the effects of technology on the translator and the translation process. Addressing research questions in this area requires a cognitive approach that puts

the translator in the center and is combined with a consideration of the tools, technology, and physical setting that are all a necessary part of, and impinge on, the situated activity of professional translation. Cognitive translation research uses a variety of methods in its attempt to gain information about the internal processes and decision-making involved in professional translation work. Monitoring actions that take place on the computer screen, reconstructing the translation process to understand individual steps and decisions, and asking translators to reflect on what they do and why have contributed to a greater appreciation of the competences and skills involved in transferring texts from one language to another (e.g., PACTE 2009; Göpferich 2012; Ehrensberger-Dow and Massey 2013).

Working conditions and psycho-physiological components have been assumed to be important in translation performance, but they are difficult to address from a purely cognitive perspective. Translators clearly interact with the machines they use, adapting them to suit their needs if possible or perhaps adjusting their cognitive processes to fit the machine (e.g., Hansen-Schirra 2012; Moorkens and O'Brien 2013; Mesa 2014). Translation performance is presumably affected not only by what happens in the translator's mind or on the computer screen, but also by how translators interact with their environment and how they react to their working conditions.

Although some research has been done into the realities of the translation workplace (e.g., Risku 2002; 2014; Hébert-Malloch 2004; Koskinen 2008; Désilets et al. 2009; Kuznik and Verd 2010; Ehrensberger-Dow 2014), most translation process studies have focused on differences between students and professionals, or translators and non-translators, without considering how workplace ergonomics can influence translation performance. This calls for reembedding translation process research in the locus of the situated activity – which must be the workplace in the case of professional translation.

In a previous longitudinal study at our institute, the translation processes of students and professionals were collected over a period of up to five years.² Many insights were gained in that study about the practices and strategies of translators at different levels of competence, but indicators of disturbances to translation processes and performance were also noted in the screen recordings and processes that could not be explained in linguistic terms or with respect to translation experience or competences (see Ehrensberger-Dow and Massey 2014). Another source of data in that study was ethnographic observations of the constraints that the translators were working under: factors such as economic, institutional, and technological influences on the work situation as well as the specific task that the translator had to accomplish were noted and included in each translator's profile.

2. *Capturing Translation Processes*, see www.linguistik.zhaw.ch/ctp for further information.

During the course of the study, some of those constraints changed for some of the professional translators, and it became increasingly clear that a deeper examination of external influences would help to understand their work demands and practices and the impact of disturbances or interruptions. This was the primary motivation for a follow-up interdisciplinary research project, designed to investigate the ergonomics of the technologized translation workplace.³ The project is introduced briefly below in order to provide the context for the case study examined in detail further on.

3.1 Research design and questions of interest

The interdisciplinary project *Cognitive and Physical Ergonomics of Translation* was carried out with translation studies, occupational therapy, and usability researchers. It focused on the workplace ergonomic conditions of translators working under various employment arrangements (e.g., as commercial staff, institutional staff, or freelance translators) with differing degrees of control over their translation workflow – e.g., centrally-organized or self-organized – in a variety of settings (e.g., working with many people in open-plan offices vs. alone or with one other person in small offices) with a high or low use of CAT tools. These variables combine to describe typical profiles of professional translators, whose ergonomic conditions are expected to differ accordingly (see Table 1). The shaded cells in the table, for example, indicate the profile for a translator who used CAT tools a lot, shared an open-plan office with several colleagues, and was employed by a company that organized her workflow for her. This profile can be considered quite typical for staff translators working at commercial language service providers.

The multi-method approach of the interdisciplinary project, which comprised several types of data collection as well as phases of analysis and synthesis, contributed to providing opportunities for translators' voices to be heard. The interdisciplinarity of the project also made the research questions of interest quite accessible to translators and their employers, since the concept of physical ergonomics was easily understood, while at the same time ensuring that assessments of the latter did justice to the nature of translation work and complexity of technologized translation workplaces. For an outsider, which is what the occupational therapy researchers were when the project planning started, translation at a computer may seem to be a monotonous, repetitive, and possibly boring task since translators tend to sit very still and stare at the screen for long periods of time. The heavy use of CAT tools,

3. See www.linguistik.zhaw.ch/ergotrans/en for further information about the interdisciplinary team and the project.

Table 1. Possible workplace profiles based on ergonomic considerations of professional translation

Group 1	commercial staff translators							
Workflow	centrally-organized				self-organized			
Office style	open-plan		(semi-)private		open-plan		(semi-)private	
CAT tool use	high	low	high	low	high	low	high	low
Group 2	institutional staff translators							
Workflow	centrally-organized				self-organized			
Office style	open-plan		(semi-)private		open-plan		(semi-)private	
CAT tool use	high	low	high	low	high	low	high	low
Group 3	freelance translators							
Workflow	centrally-organized				self-organized			
Office style	open-plan		(semi-)private		open-plan		(semi-)private	
CAT tool use	high	low	high	low	high	low	high	low

with consequent clicks to accept TM matches and sometimes the small number of keystrokes to edit them, hides the high level of concentration and attention to detail that grappling with a specialized text requires. During the pilot stage of the project, the granularity of the occupational therapy instruments had to be adapted several times to reflect the complexity of typical translation workplaces since “works with a computer” seriously underspecifies the nature of the activity in this context.

The main research question driving the case study presented below is how disturbances to information flow and concentration levels can interrupt or otherwise affect the translation process. Subsidiary questions are concerned with which cognitive, physical, and/or organizational ergonomic factors are related to disturbances and interruptions; how a professional translator can cope with them; and whether some might actually have a positive effect on the process. In the following sections, we illustrate how these questions can be addressed by focusing on the workplace observations of one of the commercial staff translators who took part in our project (namely, Comm103).

3.2 Ethical issues

Before moving on to describe the methods and data in detail, a word on ethics and guaranteeing the anonymity of participants would seem to be in order. In workplace studies, the potential reputational risks of the participants and employers involved always must be taken into consideration and measures implemented to eliminate them. The standard procedure is to anonymize the data by assigning

codes to the participants. In our interdisciplinary project, one of the goals was to ascertain whether ergonomic issues at highly technologized workplaces have implications for the health and well-being of the translators involved, which introduced another ethical dimension. The federal legislation concerning research with human subjects in our country (Switzerland) recently tightened to include any studies involving questions of health and not just invasive procedures or vulnerable groups. If absolute anonymity is not guaranteed, then no data about health can be collected. In order to maintain anonymity yet ensure that data from the various phases of the study could be triangulated, all of the participants were asked to assign themselves a code based on a familiar birthdate and a parent's initials. These codes served as our master code sheet and then in a second anonymization step, as approved by the governmental ethics commission, the codes were converted to fit the three group categorizations for the analysis of the data (i.e., Comm, Inst, Free) and assigned an arbitrary number. The master code sheets and all data that could be linked to individuals were destroyed after the completion of the research project.

3.3 Profiling a professional translator at work

The translator examined in depth here, Comm103, worked 31–40 hours per week as a commercial staff translator, shared an office with 10 or more people, and used a CAT tool regularly. As such, her profile matches that of the commercial staff translator in the shaded cells of Table 1 except that she worked for her employer from home one day a week. She was 26–35 years old at the time of data collection, left-handed, a touch typist, and translated mostly from her first language (L1) into English, her second language (L2), but sometimes in the other direction as well. She worked in a technical domain, often translating highly specialized texts, but also did more general texts as well because she was the only staff translator at the company. Basically she did whatever work was passed to her (i.e., “centrally organized”) but when there was too much for her to do, her supervisor consulted with her to decide which texts had priority and which had to be translated by freelancers and then proofread by her. Because of this role as a translation project manager and the possibility she had of working at home once a week, she had a higher degree of autonomy over her work than some of the other commercial translators in our project sample.

On the day that the translator was observed, she was working from home. The timing had been determined in consultation with her and her supervisor, with the objective of causing as little disruption to her normal workday as possible. Since there would have been security issues associated with workplace observations at

her restricted-access company office, she suggested doing the recording at her home office. This was somewhat unfortunate, in that the data collected in the home office situation may not be representative of how she worked in the company office. However, it provided the research team with the opportunity to gain more insight into how commercial translation practices might differ depending on office settings, since she talked about the differences.

Screen recording software was installed on Comm103's laptop computer and tested in advance.⁴ Everything that was visible on the computer screen during the observation period was recorded and rendered as .avi files (approximately 2.5 hours of recording in total). In addition, video recordings of the translator's workplace were made, the video camera being positioned so that the translator, her entire desk, and all of the artefacts could be seen. The audio channel of the video recorder was turned on in order to capture any ambient noise, voices, phone calls, etc. An adapted version of the RHIA/VERA instrument for office workplaces (Leitner et al. 1993) and an internally-developed ergonomic assessment (Neck-Häberli & Bregger 2013) were carried out by the occupational therapy researcher at the end of the observation period. Both a translation studies and an occupational therapy researcher were present during the recording session: one of them made field notes that were consolidated with the results of the observations and assessments.

4. Observations and their ergonomic implications

The findings reported in this section have been triangulated from the observations and recordings made at the translator's workplace while she engaged in tasks that were part of her normal workload. The workplace setting and any disturbances or interruptions external to the translation process are described and analyzed with respect to their ergonomic implications. In addition, an in-depth analysis of the screen recordings identify ergonomic issues associated with this translator's use of language technology.

4.1 Workplace setting

Like many of the other commercial translators in our sample, Comm103 used two screens for her translation work. She had a laptop with a small screen (44 cm diagonally) raised about 8 cm on a clear acrylic stand at a slight angle to the left of

4. http://www.bbsoftware.co.uk/BBFlashBack_FreePlayer.aspx

her widescreen LED monitor (59 cm diagonally), which she sat directly in front of. During the observation period, she used the laptop screen as the operational interface (e.g., to manage files, open programs, and check e-mail) and the larger screen as the working surface for her revision and translation activities. She always used her ultrathin peripheral keyboard with flat keys and an integrated number block, which lay flat on the desk in front of her, rather than switching between it and the laptop. She used a wireless computer mouse on a mouse pad with her right hand, usually resting her index and small finger on either side of the mouse and scrolling with her second finger on the mouse wheel, which caused her third finger to move in parallel. Although she frequently used keyboard shortcuts, there were numerous switches between the keyboard and mouse. If she kept her hands on the keyboard more, for example by moving the cursor with the arrow keys instead of switching to the mouse and scrolling, she might reduce the potential of being distracted from the task at hand, of losing her place in the text, and of repeatedly having to reach for the mouse. Her frequent mouse activity might explain the source of the moderate pain in her shoulders, upper back, and neck that she sometimes experienced, since she reported that she had no other health problems except tired eyes occasionally.

The main activities on the day of recording included editing five technical texts in Comm103's L1 and the subsequent translation of them into her L2 using translation memory (i.e., Trados Studio 2011).⁵ With respect to easing the cognitive load of the translation task, the translator was able to check her comprehension of the source text (release notes for a user interface) by going to the interface online and testing aspects of it. In addition, she made use of a variety of online and offline resources. During the observation period, she referred to a dedicated terminology databank, concordances, a CD-ROM bilingual dictionary, two online bilingual dictionaries as well as background material and parallel texts that she found using a search engine. There was also some reference made to materials provided by the commissioner of the translation, but the translator reported that such materials were not often available. Other software that Comm103 used during the period of observation included a text editor (MS Word) and a spreadsheet program. A linguistic reference book and a specialized dictionary were on the translator's desk, but she did not refer to them during the observation period.

5. Trados Studio 2011 <http://www.sdl.com/products/sdl-trados-studio/>

4.2 Disturbances and external influences

With respect to disturbances and external influences, there were relatively few apparent to the researchers during the 3-hour observation period other than e-mail, which was Comm103's primary communication channel, and phone calls. The office setting was very quiet in general, with little noise except the translator's own mouse clicks. According to her, it is much more difficult for her to concentrate in her company office because of the ambient noise, phone calls, and distractions from colleagues. In addition, her desk is the closest one to a restricted access door which she often has to get up to open for visitors. Extrapolating from the observations during the recording period and information acquired during an interview afterwards, Comm103 is probably interrupted by people, e-mail messages, or phone calls between 10 and 40 times per day. The majority of these interruptions might only require a short orientation or brief response, but some require a more comprehensive response and correspondingly more cognitive attention, repeatedly pulling the translator away from her primary task of translating. The time devoted to dealing with the interruptions is estimated to be on average 60 minutes per day over a typical month. If these interruptions do not comprise components of Comm103's tasks or job description, then they represent lost productivity. And even if they concern aspects of her duties, they probably have a negative effect on her concentration and cognitive processing. On a positive note, however, some also represent opportunities to engage in networking activities, which can increase job satisfaction.

During the morning observation period, Comm103 wrote and read brief notes on a sheet of paper on the left side of her desk three times and drank from the glass of water placed slightly to the right of her large screen. Otherwise, she worked non-stop and remained in practically the same position for almost 1.5 hours, with little movement except for typing, scrolling, clicking, and looking back and forth between her two screens. At one point, she glanced at the window and then stood up to close it, presumably to block out some (rather quiet) construction noise from outside. After about 50 minutes, she seemed to become somewhat restless, swiveling on her chair and scratching her head several times during the last 30 minutes of the observation period. These behaviors indicate that the translator was experiencing some low-level physical discomfort that might have been alleviated by a short break sometime earlier during that period. According to good-practice ergonomic guidelines for continuous computer work (e.g., SUVA 2010; CCOHS 2011), breaks of 5–10 minutes per hour or mini-breaks of 30 seconds every 10 minutes are recommended. Whether she realized it or not, Comm103 may not have been working as efficiently as she could have as lunchtime approached (she stopped exactly at noon), because she had failed to allow herself any other breaks.

4.3 Effects of external disturbances

A closer examination of Comm103's screen activities revealed that minimizing interruptions even in the quiet setting of her home office might be an important factor in optimizing her workflow. For example, she kept her e-mail program open while she was working on a translation because she was waiting for a target text (TT) from a freelancer. Whenever a certain icon on the laptop flashed, she glanced over and then briefly interrupted her translation process to check the urgency of the incoming message. Sometimes the message had not yet actually arrived in her inbox, perhaps because of a synchronization problem with the remote access, so she had to wait or check again later. If the message was urgent, she dealt with it immediately and otherwise she returned to the translation task. Even after a short interruption like this, she seemed to have trouble picking up where she had left off: she moved the mouse cursor over previous segments, perhaps in an effort to recall what she had been doing, before she scrolled back to the active segment and continued to produce TT.

In another instance when the mail icon flashed, she delayed checking her inbox until she had pasted text that she had been searching for into a segment (number 36), which she then closed. After reading three e-mail messages on her widescreen, she clicked on the TM tab on the laptop, which re-opened the TM on the widescreen with the document cursor positioned at the beginning of segment 37 (at time 01.15:12). Instead of continuing to translate at that point, she proceeded to engage in a sequence of non-productive activities that did not seem related to the task at hand and suggested cognitive overload. She moved the mouse cursor back to the mailbox icon on the task bar on the laptop, triggering the popup 'no messages'; then to the Word icon on the laptop (at 01.15:20), triggering the miniature of the document that she had proofread much earlier on; and then to the TM on the widescreen, scrolling upwards so that more of the previously translated segments were visible. She moved the mouse cursor back to segment 37 but then at 01.15.27 opened segment 41, without doing anything in segment 37. She moved the mouse cursor over the TM entry (a 99% match) but did not choose it and left the source text (ST) in the segment field. The three segments that she had skipped over were automatically highlighted in yellow (i.e., feedback from the TM system that segments had not yet been dealt with), which might have prompted her at 01.15.33 to click into segment 37. She did not translate the ST that had been automatically inserted into segment 37 but clicked in the following three segments without translating them. At 01.15.46 she finally started to translate again (in segment 41), more than 30 seconds after she had finished dealing with her self-imposed interruption of checking her incoming messages. If the return-to-task time is added to the calculation made above for

dealing with interruptions, then a more realistic estimation can be made of their effect on the translation process. And if information like that could be provided to the translator when she is not in the middle of a taxing activity (for example in professional training sessions or coaching), it might help her to organize her workflow more effectively, perhaps turning off the incoming mail notices while she is in the middle of a translation.

4.4 Ergonomic issues associated with use of language technology

At the micro level, there was also ample evidence in the screen recordings that software issues sometimes interfered with the smoothness of Comm103's translation process. For example, in her first translation, she copied a metatext hyperlink from a cell in a Word table into the cell for the English TT title and then tried unsuccessfully to edit it. She was unable to delete part of the hyperlink without losing it all, undid the edit, and then unintentionally selected the ST title in the adjacent cell when she selected the hyperlink. After these five actions, she finally deleted the hyperlink and typed a TT title from scratch in the TT title cell. She performed minor edits on the ST and then copied it, including the ST title, into the empty cell to the right. She then selected the ST title in the TT cell, presumably to delete it, which somehow also triggered the selection of the adjacent cell with the ST. She had to redo that action in order to select only the ST title and delete it. The layout of a ST separated by paragraphs in different cells in the left-hand column of a table with the corresponding TT in the right-hand column may be useful for comparisons of the ST and TT at various stages of the process, but the settings for Word tables do not seem to be ideal for copying and pasting blocks of text. If the translator had taken a moment to reflect on what was happening, she might have changed her approach and used features such as double clicking for this particular type of task.

Comm103 did not seem to have optimal settings for her working style. Every time she opened a file on her widescreen monitor, she increased the magnification from 100% to 130% yet the document still only took up about half of the width of the screen. She often followed the text she was reading with the cursor (both on the laptop and widescreen), perhaps to minimize the risk of accidentally skipping a line. Given the level of detail of the proofreading work she had to do to prepare each ST for the translation phase, it would have been better to increase the magnification more. Once she had prepared a ST, she opened the TM program (patiently waiting about 30 seconds each time) on the widescreen monitor in front of her and began working through the translation segment-by-segment, referring occasionally to the table with the ST in the (non-magnified) Word document she

had moved to the laptop screen. The size of the widescreen in front of her would be suitable for working with TM, but the font size was quite small. Becoming more aware of warning signs, such as when she begins to lean forward to see the screen, might help prevent mistakes or fatigue. Considering that she reported experiencing eye strain and sometimes wore contact lenses or glasses while she translated, this translator might do well to consider taking the time to find out how to change the default settings in the software she uses regularly so that the magnification is at a comfortable level for both of the screens she uses.

Other features of the TM software that Comm103 was using also seemed to be less than optimal for her needs. The auto-suggest feature was turned on, resulting in pop-ups of supposedly helpful matches of previously-translated segments. Much of the time, she ignored the suggestions and typed the TT directly into the segment field. In some cases, this seemed very sensible (e.g., when *Is* and *It* were suggested after she typed *I* and intended to write *If*). At one point, she typed *the check* and then completed the compound noun and clause by typing what was provided in the pop-up suggestion (*checkbox is activated*) instead of simply selecting it. One possible explanation is that she found the first suggestion useful and consciously chose to type it rather than select it for some reason. Another possibility is that there were simply far too many suggestions offered to bother evaluating (i.e., *checkbox is activated*, *completely delete*, *completely*, *check box*, *checkbox*, *complete*), so she relied on her internal resources. The latter explanation is supported by another incident slightly later in the process: the translator selected the non-highlighted second choice in a list of three (i.e., *deleted*) but then typed 23 characters immediately afterwards (i.e., *according to the selection*) rather than selecting the second of a list of six (see Figure 1).

Figure 1. Pop-up auto-suggestions offered by the TM software

When various suggestions appeared in a pop-up, the top entry was highlighted in dark blue and as Comm103 continued typing, the highlighting sometimes switched down the list to another suggestion. However, some of the highlighted suggestions in the pop-up list did not seem to make any sense with respect to the surrounding text, which may be another reason that she often seemed to ignore them. The TM software offers the possibility of fine-tuning the auto-suggest feature, but that would have required searching for the relevant information on the

web and then carrying out eight steps to do so.⁶ It is unlikely that most translators, Comm103 included, would have the time or inclination to fine-tune their language technology to this degree, even if they realized that this possibility existed or that it might help them in their work. More likely, ergonomically-oriented research such as that described here could contribute to optimizing translator-computer interfaces and easing the socio-technical changes introduced with new software releases (cf. Doherty and King 2005).

5. Preliminary conclusions and further directions

The in-depth examination of this case study of a workplace process supports the claim that disturbances and cognitive, physical, and organizational ergonomic issues at translators' workplaces can have an impact on the efficiency of translation processes. The second phase of our interdisciplinary project attempts to isolate the effect of certain disturbances on the translation process by replicating them in the controlled setting of a usability lab with the same professional translators. By combining these results with those from the workplace recordings, it should be possible to derive recommendations about how such ergonomic issues can be dealt with and their negative consequences minimized. Understanding more about disturbances and interruptions that negatively affect translation performance should contribute to individual adaptations and feedback loops being built into the systems that translators are embedded in.

Considering translation as a situated activity involves appreciating not only what happens in the translator's mind as reflected by the target text emerging on the computer screen, but also how the translator interacts with and adapts to the physical, technological, and organizational environment. If translators are overly constrained (e.g., by the tools they use), they may adjust their cognitive processes and actions to fit those constraints instead of searching for creative solutions to the problems that TM and their other language technology tools cannot properly deal with. Yet it is exactly these sorts of problems and solutions that require the value-added of human translation and could serve as opportunities to develop translation expertise.

As Shreve (2006: 32) points out in his discussion of deliberate practice, "the repetition of tasks at lower levels of difficulty has little effect on skill improvement." In his terms, an expert translator "makes superior choices consistently,

6. <http://kb.sdl.com/kb/?articleid=3299&source=article&cid=23&#tab:homeTab:crumb:7:artId:3299>

even when confronted with the great variety of linguistic, semantic, and other difficulties inherent in highly variable and potentially flawed source texts or when faced with unclear commissions and the threat of deadlines” (Shreve 2006:31). Overly constrained and/or non-ergonomic workflows might therefore result in translation professionals becoming very good at developing work-arounds and handling routine tasks. However, if all elements of the system are optimized and work properly, then translators’ cognitive resources could be freed up to deal with novel problems or to change their settings and tools to meet their new needs – a sign of adaptive expertise.

Our research suggests that a heightened appreciation of the importance of ergonomic resources, tools, settings, equipment, and organizational systems can provide a form of feedback to help translators and companies design more user-oriented workplaces, tools, and workflows. As Bransford et al. (2010:830) warn, “[t]raining dedicated to high efficiency can overly constrain transfer and restrict it primarily to highly similar situations.” Translators cannot rely on routine solutions and automaticity, since their “input is never exactly the same and idiosyncratic, ill-defined problems are the norm” (Muñoz 2014:9). They need to develop adaptive expertise, extrapolating from their experience in order to develop innovative practices and procedures and adapting to changing circumstances (cf. Holyoak 1991; Hatano and Inagaki 1992). The adaptations that will be needed cannot be foreseen in advance, so purposefully providing feedback about essential elements of the system might be a key component in developing adaptive expertise. For the reality of the highly technologized translation workplace, focusing on ergonomics in all its facets would seem a good place to start.

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