Broadening the scope of Translation Process Research

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Abstract

This paper delves into the study of the translation process using a novel keylogging tool applied to natural or open data collection sessions, denoted *uncontrolled sessions*. These sessions differentiate from classical (controlled) sessions in that data is collected in translators' natural working environment, where they can use any resource or tool in an unrestricted manner. We will illustrate the kind of data and analysis that can be done and will discuss the benefits as well as the challenges of such studies.

Keywords: keylogging, translation process, computer-assisted translation, digital resources, uncontrolled sessions

1. Introduction

The translation process (TP), understood as the cognitive and behavioral tasks that take place during translating, is a complex cognitive process and the competences needed to carry it out efficiently are acquired gradually along the training that translators receive (PACTE 2008). The TP process is widely studied in order to find explicit relationships between the internal processes that an individual makes when translating, the external stimuli that the individual receives and the final product. A considerable amount of studies has been published using well known techniques originally from other research fields, in particular from psycholinguistics, in which observation, verbalization and/or screen recording protocols were used in combination with retrospective interviews to study different phenomena in translation. These studies can be divided into product-oriented and process-oriented.

The former base their results on the translation (that is, the product generated by a human translator) and the latter base their results on the intermediate steps that occur until the translation is finished.

The first process-oriented studies appeared for writing processes (not specifically for translation) in the late 70's reporting on high school students that were videotaped and timed while they were writing essays with different discourse purposes (Matsuhashi & Cooper 1978). Others followed a similar approach, for example Benesch (1987) and Collier (1983), but later on, videotapes were replaced by computer software that records the writing activity; see for example, Sirc & Bridwell-Bowles (1988) and Collier & Werier (1995). Specifically for translation, process-oriented studies emerged in the 80’s, for example Krings (1986) and Gerloff (1988). A more recent and popular method to empirically study writing processes involves the use of keyloggers. This kind of software collects keyboard and mouse activity, allowing to obtain a precise and objective record of the activity of a subject while performing a writing task. Keyloggers have been used since the 90's and since then, the available bibliography on this topic has grown exponentially.

Today, the most widely used tools for these studies, InputLog (Leitjten 2005) and Translog (Carl 2012), present some important limitations that make them not suitable given our particular experimental setup and facilities. This motivated the development of a customized keylogging prototype, which we adapted to be applied in translation sessions that explore the use of computer assisted resources during specialized translation.

This paper describes the particular context for our data collection task and discusses the benefits, as well as challenges, of broadening the scope of translation process research (TPR) by allowing the use of resources in an unrestricted manner.

2. Methodologies for TPR

Translation process is the combination of cognitive processes triggered during the translation task that generates a target text. TPR generally focuses on the translator's mental processes and work flow (or working environment), referring to *internal* and *external processes*, respectively (Schubert 2009). Internal processes are defined as the mental activity that gives rise to translations and that is not directly observable in the subject, such as memory access; on the other hand, external processes are those that can be observed as they are manifested by any corporal expression such as movements when writing on a keyboard or voice when narrating actions. Both types of processes are related, as it is assumed that each external process or observable action has its counter-part internal process. That is why TP is studied as the interaction between mind, body and environment.

TP research has been influenced by a variety of disciplines (linguistics, psychology, neurosciences and cognitive sciences, just to name a few) that have contributed methods and research instruments which led to the first studies (O'Brien 2013). These are the most used methods: observation protocols in which the subject is observed and the elements that seem important are recorded; verbalization protocols which ask the subject to verbalize each action he or she thinks is internally doing; retrospective protocols which are based on interviewing the subject or asking for the subject to complete a form after finishing the task to review some aspects of what has been done.

Despite being widely accepted as highly rigorous and formal, these protocols are not ideal in terms of the time it takes to manually analyze the data of each subject but, more importantly, their ecologic validity has been put into question. Some of the weaknesses pointed out include the complexity of building and applying them, the additional effort that slows down the translation task and the subjectivity that could be added to results. Moreover, some believe they are not appropriate to investigate the translation task given that the internal processes (text comprehension, lexical access, translation, etc.) are interrupted by the external processes (e.g. verbalization) making the subject aware of the otherwise unconscious internal process, which become external (Krings 2001, Li 2004 and Bernardini 2011).

In recent years, thanks to technological developments and cheaper computing power, TPR has benefitted from new methodologies for the collection and processing of data corresponding to keyboard, mouse and eye movement activity. The tools that allow to collect this data are known as *screen-recorders, keyloggers and eye-trackers;* their main advantage is that they add objectivity, replicability and quantitative analysis to translation studies.

Screen recording is done through a software that records all the activity that has taken place during a translation session, rendering a video that can be used to recreate the process after a session to confirm or discard hypotheses, to sync-up data from various sources, to annotate the translation linguistically, etc. They are available in a variety of presentations (proprietary, open source, multi-platform or platform-specific), so they can be used in nearly any setup.

However, eye movement data collection cannot be done just using a software. Special hardware is also needed to identify the pupil, record at which point of the screen the eye is fixated, detect pupil dilatation and fast eye movements (saccades). This allows researchers to analyze which part of the text (source or target) is being looked at and for how long, to support their hypotheses or conclusions. Adding eye-tracking data to TP studies implies additional costs (equipment and specialized personnel to handle it) that cannot always be afforded and in some cases, it is not even possible to use it due to the particularities of the setup chosen. To date, studies that use eye-tracking generally use equipment that can be a head-mounted device (helmet or glasses) along with the accompanying software components that provide data analysis functionalities and sometimes video recordings.

Ideally, different methods (keylogging, eye-tracking, screen recording, retrospective interviews, and environment video cameras) should be combined to allow the triangulation of the collected data, and that way reinforce the proposed conclusions. Since this research is exploratory, we only used mouse and keyboard data.

3. Experimental sessions

Translation process studies have been traditionally qualitative, leaving room for subjective considerations (grading scale, quality analysis, error categories, interpretation of results, etc.), and narrowing the possibilities of replicating the experiences. Being the subject a person, there will inevitably be aspects left to subjectivity, such as the effects of the participant's predisposition towards the experiment or the effects of the researcher's expectations, as explained in Kirk (1982).

Some decades ago, experimental studies became more rigorous through the use of solid experimental design and statistical analysis of the collected data to be able to establish well founded cause-effect relationships, if any.

Given the importance and implications of the methodology used in a study, we distinguish between *controlled* and *uncontrolled* sessions: controlled sessions are those which have a rigorous experimental design, include a dependent and non-dependent variable definition, subject groups, induction protocols, condition balancing, among others, while uncontrolled sessions, are those in which the subject is monitored in his everyday working environment and that have almost no formal design except for some basic planning with respect to the text to be used, the phenomena to study, etc. Each type of session has their advantages and disadvantages but we believe that it is important to start considering data collection in uncontrolled sessions as those are the normal conditions for translators and there is evidence that more attention is being paid to such studies. See O'Brien (2007) Pym (2011), Simonsen, (2011), Muñoz Martín (2014: 70) and Hvelplund (2017).

When it comes to result analysis, in the case of the controlled sessions, it is possible to apply inferential statistics, such as a hypothesis test and variance analysis, while uncontrolled sessions are more suitable to apply descriptive statistics or exploratory data analysis in case studies.

4. Keylogging tools

The most widely used are Translog II (Carl 2012) and Inputlog (Leijten 2005). Both record keyboard and mouse activity, can be connected to eye-tracking devices and can replay the session for retrospective research activities. The main differences are that InputLog records audio for those studies that use verbalization protocols, it captures the activity in every open window and has the option to interact with word processing and spreadsheet products to analyze the collected data; these functionalities cannot be found in Translog II. Despite these valuable characteristics both share the same limitation: they only run on one operating system, which is not precisely the one used at our institution and therefore they cannot be used in our sessions.

As an alternative to existing keyloggers, we proposed to prototype a customized solution, which evolved into the tool called ResearchLogger described in (Lafuente 2015). This solution meets all our requirements as it is open source, multiplatform and records keyboard and mouse activity in every open application. To illustrate the kind of information that can be collected, Figure 1 shows a screen capture of the moment in which the student looks for the meaning of the word "*means*" in the online resource Oxford Dictionary. To study that particular moment (what does a student search? What resources does he or she use?) the information that can be extracted comprises the following: this image, that can be used as supporting material for the data analysis stage, the entire sequence of keystrokes that resulted in that term search (the log shows that the subject types "*meand",* then he erases the "*d*" with the backspace key and types "*s*" to render *means*), the name of the browser (it may be important to know whether it is Mozilla Firefox, IE, etc), the title of the window (identifying the resource used) and a timestamp for each keystroke that can be used to calculate some time indicators. This information is very useful to observe the writing process in detail.

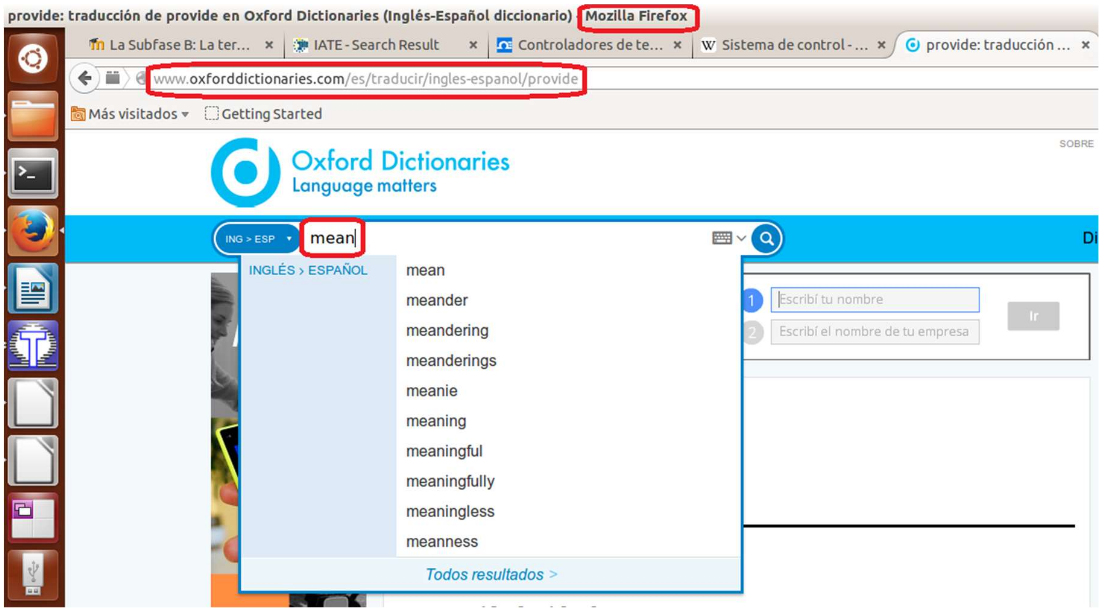


Figure 1. Screen capture of a search in an online dictionary; the pieces of information inside the boxes can be extracted to complement keystrokes and time data.

5. Our context

At the School of Languages, UNC, Argentina, students in the Technical Translation course are trained to document themselves, solve translation problems and produce texts in English with a low degree of specialization. This training usually involves the use of computer-assisted translation (CAT) tools, online resources such as specialized dictionaries and term banks, and other linguistic tools, such as checkers for spelling, grammar, etc. Students are examined twice during the academic year and they have the chance to make an additional exam if they failed one of the midterms. In either of these exams students are requested to fill in a terminology card providing information about a given term, to provide references of the resources they used to document themselves in preparation for a translation exercise and a translation into Spanish of a short technical text. Traditionally, exams assess the quality of the translation produced, the terms identified and the digital resources they report to have used to investigate those terms or used to fill the terminology card. The assessment work is done manually by professors on the product (i.e. students' exams) leaving space for uncertainty about how they arrived to those results. For example, how many resources did they consult before deciding what the best definition of a term is? Or did they just use only one resource? How much time did they use to document themselves before beginning the translation? What terms did they identify and then discard? And many other questions about students' behavior that any professor could ask.

We speculate that such product-based assessment can be complemented with process-based data, but given the high number of students (250+) and the work environment, classical protocols are not suitable due to the amount of time and effort it would take in terms of processing of the collected data (e.g. annotations, videos). Therefore, we explored the possibility of using ResearchLogger to collect students' activity during exams and we are currently analyzing and crossing qualitative and quantitative data.

6. Our approach

Both classes and exams take place in a computer laboratory with computers equipped with free open source programs, specifically Linux operating system, LibreOffice for text processing and OmegaT for assisted translation. Given the advantages of ResearchLogger, which allow to record a user's complete activity in every active window, we were able to put together an exploratory study to analyze the resources and tools used by students during exams.

The setup was as follows: before students entered the room, computers were running the keylogger so that it would record user activity since the beginning, including their preparation before staring the exam, for example, if they brought their own translation memories from previous exercises, if they tested internet's connectivity, etc. Once they enter the lab, they can start doing the exam, in which we identify the following stages as important to be explored:

S1: Since the student starts working on the computer until the first line is written in the text processor. This indicates that the student was able to: find and download the exam from the e-learning platform, open the text processing tool and start working on the exam.

S2: The interval dedicated to documentation and terminology management. This includes the use of the web browser, online resources and text processor, where they register previous activities. Activity during this interval indicates each student's particular way of working and could also serve to understand the results of their answers; and even potentially propose pedagogic strategies to solve the problems they encounter based on the analysis of this data.
S3: The interval dedicated to produce the translation using the CAT tool. This is the core of the exam and the students can combine any resource they need, including OmegaT, LibreOffice, web browser, file manager, etc.
S4: The interval dedicated to reviewing the exam before handing in. This stage indicates that the student was able to: finish every exercise, review the text (fixing typos, spacing, formatting, etc) and deliver the exam in the virtual platform.
These stages are of a complex nature to be automatically identified and processed but because the events logged (right/left/middle button click and keystroke press and release) have a timestamp and some of them also have an associated image, identifying S1 to S4 in the data can be manually done and once they are marked in the log, they can be (semi)automatically processed.

7. Identifying and processing specific stages

The data collected in open or natural environments allows us to get different types of indicators, including the amount of time spent in each tool, amount of time spent in each resource (for example, within the web browser tool which page is open in each tab), the searches performed and so on. In this paper, we present examples of these indicators for the four stages of interest defined previously to showcase the potential of the tool and of such uncontrolled sessions.

To identify and process S1 to S4 we mark the log to separate it into four corresponding portions; this is not always straightforward as each student has a particular way of working and it is necessary to familiarize ourselves with that before processing the logs.

The first stage (S1) is usually quite short and it comprises the line of the log that contains access to the e-learning platform and it finishes when the student start typing in the text processor, after saving the document in his preferred location. Table 1 shows an example of S1 that happens in a time lapse of three minutes using Firefox and LibreOffice. The last column shows the keystrokes already processed and we can see that the return key has been pressed to trigger searches (↲), this student has searched for the web page of the school in two ways, first he/she goes to the university's page and he/she probably realizes that it is not the page of the school, so he/she searches for it with Google; while the search string is being typed, some corrections were made using backspace (🡐). Once the page is found, the students accesses the exam by navigating with the mouse to download the file and save it.

Time	**Tool**	**Window title**	**Keystrokes processed**
1602	Browser	Facultad de Lenguas - Mozilla Firefox	unc.edu.ar↲
1603	Browser	Facultad de Lenguas - Mozilla Firefox	aula🡐🡐🡐🡐google.com↲
1603	Browser	Google - Mozilla Firefox	aula virtaul🡐🡐🡐ual␣lenguas↲
1603	Browser	Facultad de Lenguas - Mozilla Firefox	(login information)[1]
1604	Browser	Curso: Traducción Técnica - Mozilla Firefox	(clicks to find the exam)
1605	LibreOffice	Guardar	(clicks to find location to store exam on disk + click on "save")
1605	LibreOffice	StudentX.odt - LibreOffice Writer	(keystrokes to type student's name)

Table 1. Example of keystrokes and clicks for S1. The last column shows the strings generated after processing the keystrokes pressed; special characters in the last column represent: return key pressed (↲), deletion using the backspace key (🡐), space between letter or words (␣); information in parenthesis is either confidential (login credentials, names, etc) or it is obtained from the log for mouse activity.

[1] Logs are scanned confidentially by researchers to remove any sensitive information before any processing step.

The following stage, S2, corresponds to the first two exercises, one about terminology management and the other about textual analysis; to solve them, students should document themselves and indicate the online resources they used. In this case, it is possible to reconstruct from the logs not only the text typed in the text processor as in S1 but also the searches they performed in every web page; additionally, it is possible to calculate the time spent in every tool, to break it down by resource and to calculate the pauses between words or within a word too. To illustrate this, Table 2 shows the S2 of one log, where the student only used the web browser and LibreOffice (column "Tools"); column "Keystrokes" contain the terms searched in each resource ("Window title"), and the las two columns show the time spent in each tool rounded to minutes ("Time/Res") and in percentages ("%/Resource") relative to the total time of the session which was 118 minutes in this case. In the column "Keystrokes" in addition to the special characters for backspace, return and space, key combinations appear combined and in italics, for example "shftr+." stands for shift right and period, which produces a semicolon. Figure 2 shows a screenshot of the search that resulted in student's answer to the terminology management exercise (shown in Figure 3); the boxes indicate the resource used, the term found and the definition. As it can be seen the definition is selected with the mouse and the log confirms that the student copied it (using keys control and v) and pasted it also using a shortcut; the result of this action can be observed in Figure 3, marked with the ellipse.

Tool	Window title	Keystrokes	Time/Res	%/Resource
LibreOffice	StudentX.odt - LibreOffice Writer	click click⌋*shift*+*g* enero *shiftr*+. ⌋ ⌋ inte←←←← *shiftl*+*t* ipo	14	11,86%
Firefox	Google Search	Process control system	2,25	4,54%
Firefox	Google Books	Routledge Diccionario Técnico Inglés	9,36	18,52%
Firefox	WordReference.com	sensor	0,18	0,36%
Firefox	IATE	sensor	0,74	1,50%
Firefox	alphaDictionary	Specialty Dictionaries	9,15	18,45%
Firefox	EuroTermBank	Terminology Search	0,20	0,40%
Firefox	Wikipedia	Sistema de control	0,35	0,71%

Table 2. Example of log processing to analyse S2. Column "Keystrokes" shows a small excerpt of the production in LibreOffice (see also Figure 3) and the searches performed in each resource (column "Window title"); special characters represent the same as in Table 1.

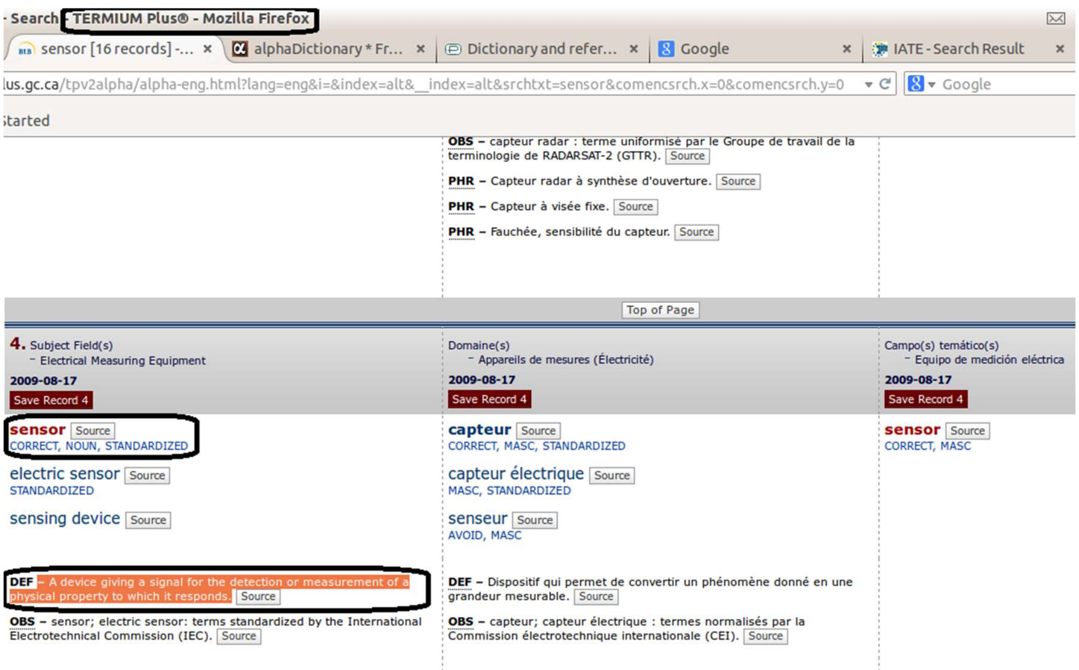
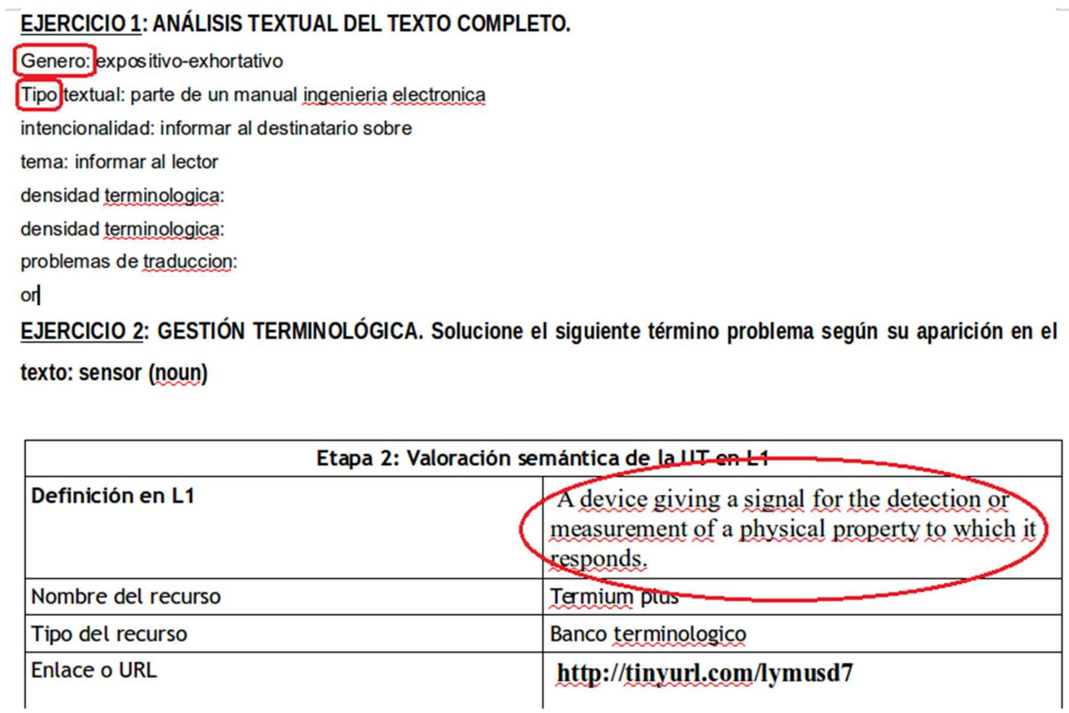


Figure 2. Screenshot of a moment in S2 during which the student is researching about the term "*sensor*"; this resource is part of the analysis shown in Table 2.



EJERCICIO 1: ANÁLISIS TEXTUAL DEL TEXTO COMPLETO.

Genero: expositivo-exhortativo

Tipo textual: parte de un manual ingenieria electronica

intencionalidad: informar al destinatario sobre

tema: informar al lector

densidad terminologica:

densidad terminologica:

problemas de traduccion:

or

EJERCICIO 2: GESTIÓN TERMINOLÓGICA. Solucione el siguiente término problema según su aparición en el texto: sensor (noun)

Etapa 2: Valoración semántica de la UT en L1	
Definición en L1	A device giving a signal for the detection or measurement of a physical property to which it responds.
Nombre del recurso	Termium plus
Tipo del recurso	Banco terminologico
Enlace o URL	http://tinyurl.com/lymusd7

Figure 3. Screenshot of one moment in S2 where the student has solved the terminology management exercise and is working on the textual analysis exercise. The excerpt in Table 2 corresponds to an earlier moment when the student was writing "*Genero:* " ⌋ "*Tipo*" (marked with the boxes).

Stage 3 concerns the production phase, i.e. the use of the OmegaT CAT tool to generate the translation of the given text. Besides reconstructing the text produced, calculating the time spent in the translation and the resources consulted, it is possible to study other aspects here such as the use of shortcuts to navigate the tool or the activation and insertion of matches in the translation memory or the glossary, maybe through the combination of clicks and screenshots. Figure 4 shows a screenshot of the use of OmegaT.

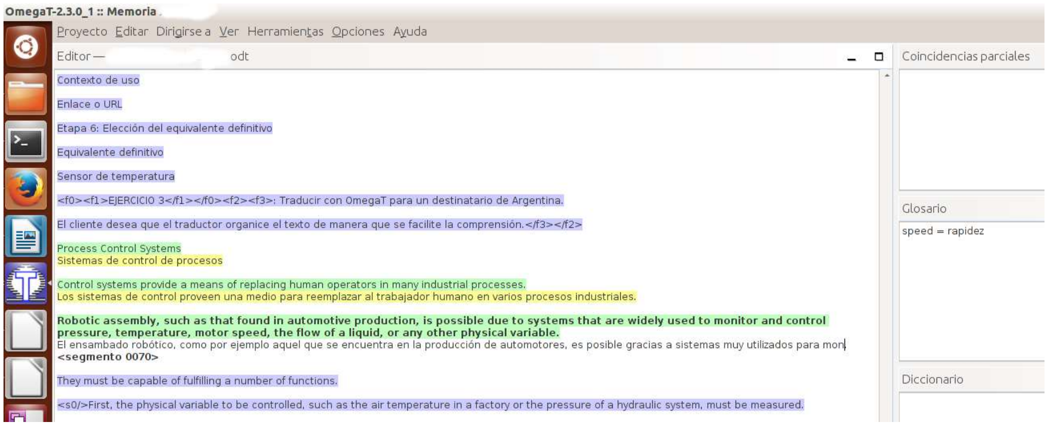


Figure 4. Screenshot of the use of OmegaT to generate the translation; this stage might also be combined with the consultation of resources.

Finally, S4 comprises the review and correction of the exercises, plus the hand in or upload to the e-learning platform. Similarly to S1, this is usually a short stage but the difference is that students have probably revised their work iteratively as they were doing it and are thus satisfied with the content or, on the contrary, they run out of time and deliver what they have.

8. Conclusion

This article describes the use of a keylogging prototype that has been developed to fulfill specific needs of our context. We emphasize the importance of studying translation in its natural environment and describe how we carried out a pilot study with third year students of translation in their natural environment, in what we call uncontrolled sessions. Although the data collected is being analyzed, we put forward a variety of information that could be extracted to study of specific aspects of the process or of the subject. This kind of studies provide a broader spectrum of venues for reflection but they also add more complexity to the analysis and interpretation of results as many variables are not controlled and some grey areas appear. Our future work includes further analyzing the collected data and identifying results that have the potential to be converted into a pedagogic strategy that helps students refine their skills with regards to specialized translation and the use of digital resources.

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