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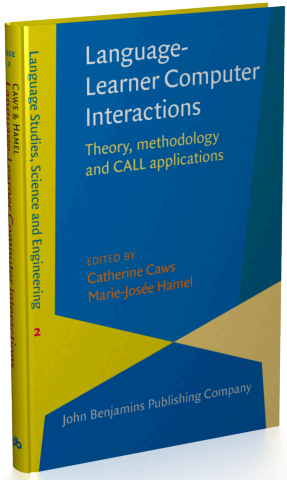

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CHAPTER 7

Video screen capture to document and scaffold the L2 writing process

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This chapter explores the potential of video screen capture (VSC) as a technology that can provide new insights when investigating learner-computer interactions in CALL research, and that can play a mediating role in second language (L2) writing pedagogy. Arguments are put forward as to why CALL researchers and language educators should be interested in this accessible and flexible tool. Three studies are described to consolidate these arguments. The first one, a usability study, investigates L2 learners' dictionary search processes in the context of the design of an online dictionary prototype. The second study examines the composition processes and strategies of L2 writers. The third study looks at the pertinence and added value of integrating VSC in the L2 writing class. Affordances of VSC arose from these studies. VSC emerged as a powerful documentation tool enabling the collection of process-oriented learner data and new forms of dynamic corpora. It also emerged as a retrospection tool capable of supporting L2 writers in their literacy development and as a scaffolding tool to provide multimodal feedback on L2 written output.

Keywords: video screen capture, L2 writing process, learner-computer interaction, dynamic learner corpora, affordances

Introduction

In the field of digital literacies, a number of technological innovations are transforming how individuals can engage in meaning making activities (Lea, 2013; Stapleton, 2010). Technologies such as tablets, voice recognition and motion capture are but a few examples of these technologies. Indeed, homework assignments, quizzes, exposure to authentic input through reading and listening tasks, composition practices, and even conversations are all pedagogical tasks that are increasingly occurring electronically in digital spaces, i.e., through computer-mediated

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environments, most often on some kind of digital screen. These technologies stand out for their potential to radically transform human-computer interaction (HCI) or what the field of CALL refers to as learner-computer interaction (LCI).

This chapter focuses on the affordances of one specific new technology particularly suited to document and exploit what happens on the digital screen when learners interact with a computer: video screen capture (VSC) technology. Drawing on the authors' own experiences with this technology and its application in three separate research projects, it will be argued that in the context of CALL, VSC offers researchers, instructors and their students a powerful means of achieving new insights and opportunities to enrich our understanding of the link between second language literacy skills development and computer-mediated language tasks (Barbier & Spinelli-Jullien, 2009).

In what follows, we will provide an overview of the nature of VSC and its appeal to researchers and educators. We will then briefly present three studies which have used VSC to document and/or enhance both students' and instructors' literacy practices in the context of CALL design and L2 pedagogy. These will be used to illustrate the nature of the data that can be collected through VSC, how it can be analysed and the types of insights it can lead to. Finally, we will highlight the unique affordances of VSC and their implications for how VSC can help advance CALL research and the design of CALL pedagogy and teacher training.

What is VSC?

VSC technology has emerged in the last few years as an increasingly popular tool used to create audio-visual documents that can help computer users share images and movies of what they do on their computer screens. In essence, VSC refers to the use of software that will allow one to record a movie of on-screen actions, which occur as an individual interacts with a computer (or a mobile device screen).

VSC is perhaps best illustrated by the growing number of self-help videos which can be found on YouTube where experts explain step by step how to use a piece of software or how to accomplish a complicated task on a computer. These movies offer an over-the-shoulder effect similar to one-on-one instruction (Carr & Ly, 2009).

Screen-recording videos are often accompanied by a voice-over recorded by the author of the recording. This voice-over provides off-screen commentary and explanations of what occurs on the screen. To create this voice-over, VSC users can choose to record their voices simultaneously as they record their screens or later in a subsequent stage as they edit the video. Additionally, audio tracks

can also be added which include all sounds generated by the computer itself (i.e., mouse clicks, the active pressing of a button, the sound of audio and video recordings played on a computer, etc.). Interestingly for research, the audio track can also at times capture indirect external sounds (such as typing noises, ambient music or the sound of pages being flipped).

Finally, many screen capture software programs allow users the choice to include in their recordings additional sources of video input in the form of the images recorded by their computers' webcams. If this option is selected, the videos produced show both what is happening on the screen as well as, often in a smaller window, a video of the user's face as he or she is interacting with the computer.

As such, through a combination of moving images and sounds, users of VSC can share with others audio-visual recordings of their actions in digital environments (everything from mouse clicks and windows closed to the text they write). Whereas in the past doing this might have required producing a document with typed detailed descriptions of onscreen events combined with static pictures (screenshots) of a computer screen, users can now relatively easily record, archive and share specific moments on their screens.

To create VSC, a number of software applications are now available. While some of these are free (e.g., Jing, Screencast-O-Matic, and CamStudio), software programs which typically offer more features (e.g., editing functions) are available for purchase (e.g., Snagit and Camtasia Studio). VSC is offered as a standard function through the QuickTime software pre-loaded on Apple computers, and increasingly VSC technology is designed to work seamlessly with popular software programs such as PowerPoint and Adobe Connect. Recently, VSC applications have also been developed for mobile devices (e.g., Screen chomp, Explain Everything).

These VSC programs offer users a great deal of choice, allowing them to select the area of their screen they want to capture (full screen or a selected window only) and what they want to capture (video only, video and sound, mouse clicks, webcam, etc.). In the majority of cases, videos produced can be saved in a number of popular formats (MP4, AVI or Flash videos) with the choice of either high or low screen resolutions.

Many of these VSC programs also permit individuals to distribute online the screen capture videos they produce in the form of *screencasts* (screen capture videos distributed online). Videos can be uploaded to the Internet and then shared easily with peers by sending out a URL link to the uploaded video or by using an HTML code to embed the uploaded video in a website.

Why be interested in the use of VSC?

In the past decade, whereas the use of VSC has been popularized by software companies and creators of instruction manuals, this software has attracted the attention of various individuals who seek to take advantage of its ability to show at a distance what they are doing on their screens (Carr & Ly, 2009; Peterson, 2007). Librarians, for instance, have turned to VSC to enhance their interactions with library users seeking help with the use of library resources (Price, 2010). VSC has also been widely adopted in the gaming community as gamers show off their skills and abilities by uploading screen-captured movies of themselves completing particularly difficult sections or elements of a video game (Gow, Cairns, Colton, Miller, & Baumgarten, 2010).

In the field of language education, VSC has slowly gained popularity as both a research and an educational tool (Drumheller & Lawler, 2011; Geisler & Slattery, 2007; Jones, Georghiades, & Gunson, 2012). Indeed, VSC offers educational researchers new ways to investigate processes associated with the various outcomes and products produced by learners through LCI tasks. It appeals in particular to researchers who are interested in detailed descriptions of the mediated nature of language and literacy development in digital spaces. This is explored in greater detail in the following section.

Exploring the mediated nature of language development in digital spaces

The ability to document and investigate LCI through VSC appeals to those researchers who frame learning within a task-based approach and who draw on sociocultural theories of language development, whereby the engine for learning goes beyond the transmission of information from teachers to students. Within these frameworks, the focus rather is on learning as the result of interactional discourses (Gibbons, 2003). These discourses are generated as learners participate in language-mediated activities and tasks that allow users to interact with the language, produce it, and refine their knowledge of its conventions and rules (Duff, 2010; Lantolf & Thorne, 2006; Vygotsky, 1978).

Through its ability to document events which occur as students interact with their computers, VSC is particularly well suited to explore this mediation process. Moreover, since VSC allows one to capture what occurs in digital spaces, it enables one to address the need to explore how the migration of everyday literacy practices into digital spaces is transforming literacy development both in and out of the classroom (Lotherington & Jenson, 2011; Stapleton, 2010; Yi, 2014).

Learners' movement away from physical pen-and-paper interactions towards forms of writing in digital spaces has enriched but also rendered the act of writing and the processes associated to the writing development more complex. As new generations of students learn to read, write and interact with computers and tablets, there have been growing calls to better understand how computer-mediated tasks and interactions affect students' abilities to engage with and produce texts. What, for example, is the impact of activities such as writing out a text long hand, looking up words in a physical dictionary, and revising and editing a printed version of a draft? All are literacy practices whose traditional forms are being gradually displaced by new practices mediated through digital technologies.

Studying these changes has been identified as an important research field. For example, in their book *Digital Writing Research: Technologies, Methodologies and Ethical Issues*, McKee and DeVoss (2007) identified a number of new areas of exploration emerging from digital writing research. These include emergence of digital communities, the notion of *ethos* and the use of ethnographic practices, as a means of exploring what occurs in digital communities. Stressing how changes in the writing context have resulted in "processes and products of digital writing" which are often "different from paper-based processes and products" (p. 9), they also stress the value of research that can capture and account for the links between writing processes associated with digital texts, the activity of learning, and multimodal spaces. VSC allows the exploration of these new types of technology-mediated processes and their roles in shaping students' understandings of *literacy processes* and development.

A tracking tool well suited for usability tests

As a tracking "see-me-in-action" tool, VSC is also attractive to all who are interested in observational research and who seek to monitor users' on-screen activities (Chun, 2013; Fischer, 2007). It can be used as an alternative or in conjunction with key logging programs to produce detailed records of users' screen activities for further analysis, and VSC can be used to conduct usability tests (Van Waes, Leijten, Wengelin & Lindgren, 2012).

Usability is a concept borrowed from HCI, a property conferred to any artefacts used by humans to accomplish specific tasks. Bevan (2009) referred to usability as *quality in use*, highlighting its process-oriented nature. Usability tests (Kuniavsky, 2003; Rubin & Chisnell, 2008) are experiments, interventions typically conducted iteratively (several times and at various development stages) with (typically a small number of) representative users (selected on the basis of prior user profile analyses) invited to perform specific tasks with or involving the use

of the artefact under development. Such interventions aim to recreate "authentic" task situations (based on prior task analyses) to observe how users:

1. Behave in such situations, in particular when interacting with the artefact;
2. Are successful at completing the given tasks; and
3. Are satisfied with the artefact for the given tasks.

Hence, a core part of any usability test is observing and evaluating various aspects of the artefact under development. For example, a usability test can be used to investigate how language learners make use of an online dictionary to address linguistic issues they are experiencing when working with texts (Hamel, 2012). Such usability tests allow CALL designers to identify aspects of the dictionary that might be redesigned so as to make its relevance and benefits for users more explicit.

VSC enables one to capture and thus observe exactly what the user is doing at the computer, hence its user-centred objective nature. In running usability tests, VSC offers a practical and relatively simple way to investigate the link between various processes and the success or failures that students are able to achieve as they complete a language learning task. VSC enables researchers to associate the actions seen on-screen to explanations (e.g., gathered from questionnaires and interviews) of why *certain students produced a text in the way that he or she has.* This is an insight which is often missing in the literature on composition studies and second language writing, where much of the work is conducted with the analysis of static, predominantly final drafts produced by students (Séror, 2013). Faced with the end product of writing, researchers and instructors are left to infer the reasons behind the qualities found in a text.

With VSC, inferences made about strategies used by students when they interact with the computer can be deducted on the basis of direct behaviour observations and the degree to which these have impacted the quality of the language output that was produced. Séror (2013), for instance, highlighted how students' composition processes were linked to students' strategic use of visuo-spatial elements (Olive & Passerault, 2013; see Chapter 9, this volume) found in digital spaces and within specific software programs (i.e., the colour and size of a window, the positioning of windows, the ability to customize the fonts and margins of a page, and the use of annotation features) when interacting with a word processor as part of their work with a text.

Similarly, researchers can verify visually, for instance, the amount of time a student actually spent revising a text before handing it in. We can explore what strategies the student employed when engaging in this revision process. Finally, we can identify what specific resources the student turned to when doing this.

These are but some of the questions that can be investigated thanks to process data, such as the type collected with VSC, which, combined with other types of data elicitation methods (such as questionnaires, interviews, talk-aloud protocols and stimulus recalls), can provide researchers (and teachers) with a more complete and accurate portrait of the language learner and his or her learning trajectory.

As a result, we can obtain a nuanced understanding of what differentiates successful and less successful language learners and their results on a language learning task. We can also importantly take into account more closely the learners' backgrounds, habits and needs, leading to recommendations grounded in authentic user-based practices regarding the best digital resources and interfaces for language learners and the design of new CALL applications.

An appealing tool for educators

Educators have also begun to explore the use of VSC. As with researchers, it is the "show and tell" qualities of VSC and its ability to produce permanent records of LCI that have attracted educators seeking to produce artefacts that can document and scaffold literacy development.

In some of the earliest applications of VSC for pedagogical aims, educators have created videos to provide multimodal feedback to students. In the videos, instructors annotate, comment and modify students' texts, offering visual, audio and dynamic dimensions to their feedback designed to scaffold students' learning and enhance what have traditionally been pen-and-paper comments placed in the margins of students' papers (Jones, Georghiades & Gunson, 2012; Mathisen, 2012; Séror, 2012).

Recently, VSC has also been used to produce video clips that are shared with students to review specific pedagogical objectives and resources (e.g., providing an overview of a grammar point) (Gormely & McDermott, 2011). This ability for educators to produce short video clips that students can watch at home is at the heart of an increasingly popular concept of *flipping the classroom* by providing information and teaching opportunities outside of the classroom so that more time can be spent in the class working on applications of the knowledge distributed to students (Khan, 2011; Toppo, 2011).

As suggested above, VSC represents an innovative tool that can be used to explore LCI and its relationship to literacy dimensions and the design of CALL tools promoting language development. Its focus on user interactions and the ability to create digital traces of language learners' actions lend themselves to usability studies which are well suited for studies of computer-mediated literacy processes (Degenhardt, 2006; Geisler & Slattery, 2007; Park & Kinginger, 2010).

In the next section, we look at three examples of how VSC has been used to explore the impact of LCI in the design of *online dictionaries* (Hamel, 2012), the development of *writing processes* (Hayes & Flower, 1980; Séror, 2013), *metacognitive awareness* (Hacker, Keener, & Kircher, 2009) and *learner autonomy* (Benson, 2001; Dion, 2011; Little, 2007).

Following brief descriptions of each project, we will seek to draw out the key lesson learned from the projects, focusing on the recommendations that have emerged from our use of VSC as a means of researching and enhancing LCI tasks.

Description of the research projects

Study 1: Investigations of *learner-task-dictionary* interaction

As part of a CALL research and development (R&D) project, Hamel (2012, 2013) employed VSC to conduct a series of usability tests on an online dictionary during its prototyping phases.

The VSC tool *Camtasia* was used to document and observe on-screen the *learner-task-dictionary* interaction. The aim was to measure the quality of this interaction, i.e., its usability, for the purpose of improving the design of an online dictionary (its interface and content).

Adopting an ergonomic approach to CALL design research (see Chapter 2, this volume), i.e., a learner-centred approach, Hamel drew on the concepts of usability (see above) and tools and techniques employed in the web engineering and interface design industry to measure the *quality in use* (Bevan, 2009). Usability tests were employed in this research as an elicitation method in order to get LCI data that would inform the design of her online dictionary.

These concepts were integrated with the use of VSC technology to facilitate the direct observations and process-oriented analyses of students' interactions with the online dictionary prototype. Language tasks were created which optimized conditions for the dictionary to be solicited during their completion process (Hamel, 2012). These were semi-authentic, corpus-driven micro-tasks for which learners had to translate, revise, construct or reformulate identified collocations, in sentence and text-wide contexts. VSC was crucial in capturing this LCI and students' solicitations of the online dictionary functions to engage in the process of constructing collocations.

The process and product-oriented LCI data collected through this study were used to directly inform both measures of efficiency and the effectiveness of the dictionary being studied. A set of parameters, based on visible on-screen actions, was devised to measure *efficiency* focusing on efforts and time at task while on

language accuracy to measure *effectiveness*. Pre- and post-task questionnaires given to the students also allowed the researchers to collect more indirect measures of learner background, experience and satisfaction with the tool. The results were triangulated, and some correlations were found between reported and observed behaviours (Hamel, 2013), namely between prior exposure to a variety of online resources and success.

Study 2: Investigating L2 writers' composition processes and strategies

Séror's (2012, 2013) research drew on the use of VSC to document and investigate undergraduate university students' composition processes and strategies as they completed authentic writing assignments in their second language. Inspired by the need for more detailed representations of the moment-to-moment actions, decisions and composition processes enacted by L2 students as they learned to write for university classes and ultimately to master the complex series of processes associated with the production of academic texts (e.g., Roca de Larios, Manchón, Murphy, & Marin, 2008; Sasaki, 2000; Victori, 1999), participants were equipped with the VSC tool Screencast-O-Matic (SOM) <http://screencast-o-mastic.com/>. Participants were instructed to record whenever they composed and completed assignments in their writing classes on their own computers. These recordings were largely conducted outside of the classroom and provided rare insights into the writing processes that underlie L2 writers' production of academic texts in authentic settings outside of the classroom.

Created unobtrusively as writers composed and completed assigned writing tasks on computers, these records were analysed in conjunction with retrospective interviews conducted to explore students' specific composition strategies, individual performances and their perspectives and justifications of the various behaviours observed in the recordings of their writing sessions.

Data-analysis procedures for the study triangulated both the video records and student interviews with a research log, field notes, and informal conversations with focal students and their instructors. A quantitative analysis of the sequences of events found in the visual records of students' composition processes was juxtaposed with a qualitative analysis of students' own perspectives of the composition processes and strategies underlying their writing.

Drawing on the work of Park and Kinginger (2010), each recording was coded for *transactions*, instances which expressed an immediate need on the part of the writer and his or her efforts to respond to a problem as identified through a series of visual signals in the screen recordings (for example, a pause, followed by the deletion of a word and the insertion of a new word, followed by another pause before continuing to write another sentence).

Study 3: Exploring the pedagogical pertinence and added value of the integration of VSC

Hamel, Séror and Dion (2015) collaborated in an on-going research project focusing on the pedagogical pertinence and added value of the integration of VSC in the second language (L2) writing class. Built on prior investigations of the digital traces of language learners using computers (Degenhardt, 2006; Geyser & Slattery, 2007; Hamel, 2012; Hamel & Caws, 2010; Park & Kinginger, 2010; Séror, 2013), the study's objective was to investigate how second language writing instructors might integrate VSC in their classroom activities and tasks to scaffold learners' writing development and design more effective, better suited and more personalized pedagogical interventions.

By means of case studies in two university L2 writing classrooms (N = 36), the research focused on the innovative practices linked to the adoption of VSC by two experienced second language writing teachers over the course of a semester. A key objective was to document these teachers' use of VSC for pedagogical purposes as well as to document the process and product of writing tasks by students as they completed these tasks, both in authentic classroom settings and outside the classroom as part of homework activities. Screencast-O-Matic was used as the VSC tool. A corpus of 200 screen recorded videos was collected and analysed (quantitatively) based on a taxonomy of functional and cognitive parameters devised from visible and audible (inter)actions identified in the videos.

In addition to the VSC recordings produced by students and instructors, classroom artefacts (e.g., task descriptions, journal entries), student questionnaires and teacher interviews were analysed to explore how the tool was used and adopted by instructors in these courses, its impact on the quality of the work produced by students and the perspectives expressed by both students and instructors as they reflected on the value of this tool for their language development.

Affordances and opportunities associated with VSC

Drawing from our own experience as practicing researchers with VSC in CALL and second language literacy development, we believe it is possible to identify a number of interesting affordances (see Chapter 3, this volume) associated with VSC. We will illustrate these below in an attempt to provide practitioners and researchers in CALL with *strong clues* about how VSC could be *fruitfully employed in design* (Norman, 1998) in *meaningful* ways (Gibson, 1997).

A tool that is accessible and easy to use

All of the above mentioned studies revealed that VSC as a tool was, on the whole, easily accessible and easy to learn to use by the researchers, language learners and language instructors. This quality is well illustrated in the research projects 2 and 3. In both cases, Screencast-O-Matic (SOM) was specifically chosen for its reliability and ease of use. SOM is a free Web-based application that does not require any specific software to be installed on the computer used for the recording. This made it a highly accessible resource for both students and their instructors and it meant that VSC could be produced in a variety of settings (recordings could be created when students were working in a lab, on a home computer or even when working on a library computer). The free version of the program allows individuals to create screen recordings of a maximum of fifteen minutes. A professional version available for a monthly fee was used in the second study and allowed participants to record their screens for as long as they wished. Once a recording is complete, users can easily save this video on a hard drive and/or upload it to a server, which can then be used to share links with other students in the class or with their instructors. Training individuals to use VSC tools has also proven, in our experience, to be relatively simple. Tools, such as Camtasia and SOM, essentially reproduce the near universal *record*, *play* and *rewind* interface found on both analogue and digital video and sound recorders.

Study 3, for instance, involved training instructors and students to use SOM through a series of workshops focused on research and teaching practice. Among attendees were the two teachers who volunteered for the project. In addition to providing training to the teachers interested in using SOM in their classroom, at the start of the semester (week 2), a researcher visited both of the instructors' writing classes and offered hands-on demonstrations of the use of SOM to their students. This demonstration helped familiarize students with the tool and also allowed the instructors to explain how the tool would be used to complete a number of the writing tasks that would be assigned to the students over the course of the semester. Students and their instructors were also provided with support material (*How to use SOM in 12 easy steps*) created by the researchers to allow students to review, at home and later on in the semester, the various steps involved in the use of SOM. The email address of a research assistant was also distributed to students and the instructors. This research assistant was presented as a resource that student and teachers could contact to ask questions and to troubleshoot any problems. As with the other studies we conducted, there were few user-related problems. The main issue which emerged were difficulties experienced by students who had to install/update their web browser's Java prior to being able to run the SOM application.

A powerful documentation tool

VSC in the three projects described above was a powerful documentation tool (Fischer, 2007), producing rich empirical records of observables generated in real-time, in both controlled as well as naturalistic settings. We stress again here that the data collected through VSC is presented in the form of screen recorded videos which include sound, image, movement and a full range of colours and modes that are essential aspects of the language learning experience in digital spaces. Researchers who use VSC can thus benefit from seeing all visible on-screen actions done by learners as they interact with texts and engage in textual meaning making.

This data is made even richer if students have opted to use their computer webcam and microphone to capture their voices and images as they engaged in LCI. This occurred, for instance, in the case of study 3 when students engaged in a writing task and chose to reflect on it in this way. Figure 7.1 shows an example of one student who chose to activate the webcam when video screen capturing her text revision process. In this extract, she is verifying a grammatical rule (about the use of gerunds in French) in a printed resource, reading it aloud and making a hypothesis about whether it applies to the text segment she has identified as problematic.

Such data is clearly important when looking at complex processes such as literacy practices, including the strategies employed by students and their underlying cognitive processes.

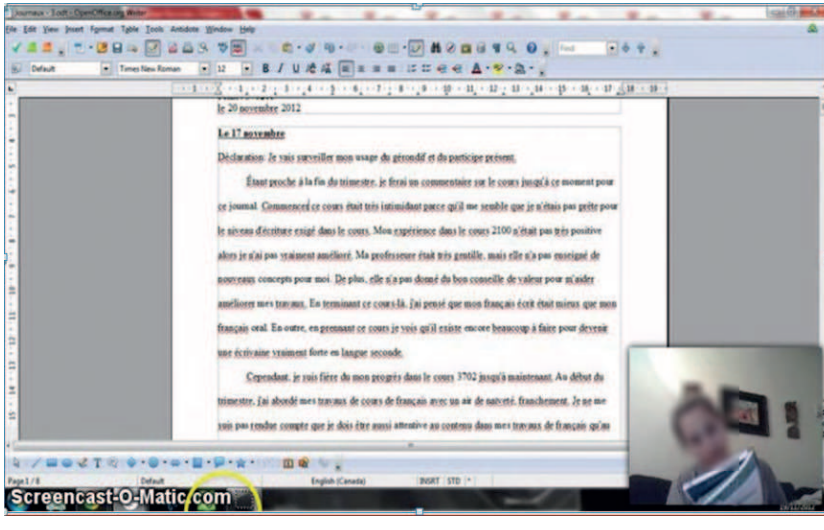

Figure 7.1 Student using VSC with webcam to document her revision process

In the case of writing, the second study produced recordings of students' writing sessions, which captured all of the activities linked to the realization of a written assignment from the first word to the last one. This allowed us to witness the multiplicity of decisions made as students moved from their original outlines, to a first draft and, finally, to a submitted text with all the micro actions that came in between (e.g., looking up a word in an online dictionary or struggling to produce a French accent). For the third study, students recorded up to fifteen minutes of their writing process (each video clip lasted twelve minutes, on average). In that short period of time, a high density of actions, both visible and audible, were observed – on average, 85 per video clip, which showed students being well invested in their writing task while revealing several types of strategies, such as focalization on form, hypothesis making, text repair, or drawing on prior knowledge.

VSC produces rich data that can be analysed in multiple ways

In all of the research projects mentioned above, it should be noted that the analysis of the data was facilitated by the use of Morae (techsmith.com), a specialized usability testing software program designed for the (distance) observation, capture, management, annotation and qualitative and quantitative analysis of VSC videos.

This program facilitates the insertion of annotations (tags) in the visual records produced by VSC. Markers and codes can be predefined and then attached as tags to the videos. These help identify parameters that can later be compiled and explored for general statistical trends within the program itself or through other programs by exporting the data into Excel files, for instance, for subsequent/further statistical analysis. Figure 7.2 shows a screenshot of Morae used to conduct usability tests with dictionaries in study 1.

Annotations added to videos with Morae can then be used to recreate timelines of events and to provide statistics regarding the quantity and general tendencies associated to key events in the data. One can calculate, for instance, the following:

1. The presence and durations of pauses taken by a student when composing;
2. The average duration of a lexical search, how students start a word search, which key word(s) they use and even which dictionary rubrics they look-up;
3. Instances when students engage in various steps of the writing process (producing text, vs. editing, vs. planning); and
4. The number of times students access online resources during their writing process and the type of resources they access (dictionaries, conjugators, translators, etc.).

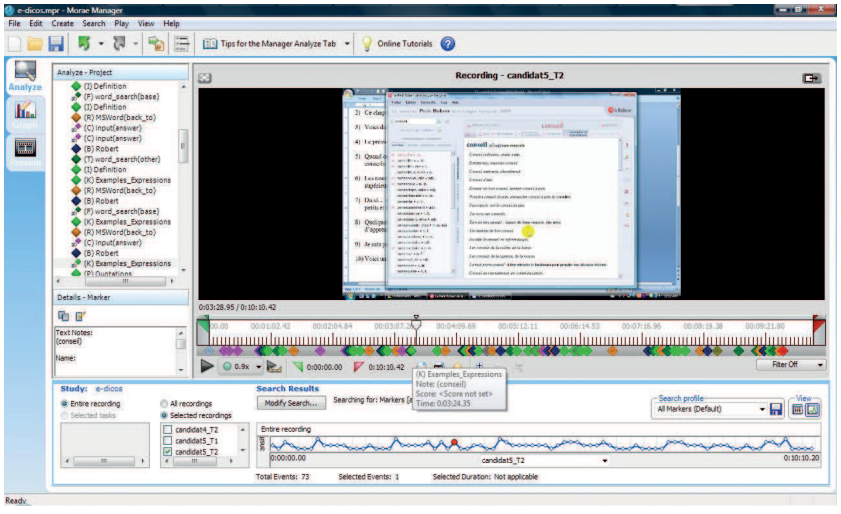

Figure 7.2 Morea, a usability test management software

Notes can also be added to the data with Morae at various points, allowing us to insert analytical memos and links to external data sources.

A tool like Morae facilitates the analysis of VSC. It does not impose on researchers a theoretical perspective or approach. Both grounded data-driven and theory-driven approaches can be applied to the nature of the data collected through the use of VSC. The approach adopted will depend on the researchers' epistemological orientation, research questions, methodological design, theoretical perspectives and pedagogical goals. In this sense, VSC remains flexible and can be used for various purposes (researching learners' information searches, researching writing processes, researching pedagogical reflective tasks, looking at peer editing, etc.).

In the case of the three studies which are the focus of this chapter, the following elements illustrate the types of analytical lens through which the VSC data collected was analysed.

Thanks to the annotation functions of Morae described above, it was possible to produce detailed timelines of task processes present in the VSC data. These timelines allowed the researchers to identify steps involved as students revised their texts. This process included selecting specific text segments, attempting to repair these segments, searching in online resources such as dictionaries, justifying in some cases the decisions made, etc.

Much like the detailed transcripts produced in conversation analysis research, these timelines offer valuable insights regarding the sequencing of events which

underlie specific events of interest and can provide hints regarding the important interplay between these events.

Guided by the question "why this now?" for instance, data emerging from study 2 helped identify moments when students turned to Internet-based sources, identifying both larger patterns of behaviours (e.g., greater use of external resources at the end of the writing session as students revised their texts), as well as unique moments linked to specific events and strategies (e.g., students' preference for specific dictionaries linked to their desire to work in their L1 or L2, depending on the lexical item they were looking up).

Similarly, LCI data from study 1 provided valuable task path sequences (i.e., navigation paths) of learners' interactions with the online dictionary when attempting to construct, reformulate or translate collocations. Hamel (2012, 2013) observed that weak learners tended to "waste" time at the beginning of their search for lexical information, hesitating about which keywords to input. Several learners looked for examples before they looked for meaning (definitions). In a series of synonyms provided in the dictionary, most learners selected high-frequents and L1 cognates over more idiomatic equivalents.

Figure 7.3 shows a 35-second task path sequence from study 1 of a participant searching for a synonym of the collocate "grande" (great) in the dictionary, starting from his search with the keyword of the collocation "joie" (joy) and finding "inépuisable" (endless) as a possible equivalent.

In study 3, using the same timeline approach, thanks to the parameters annotated in real-time in the video, it was possible to identify and reconstruct an attempt by a learner to repair a collocation as he also reflected on this task. During

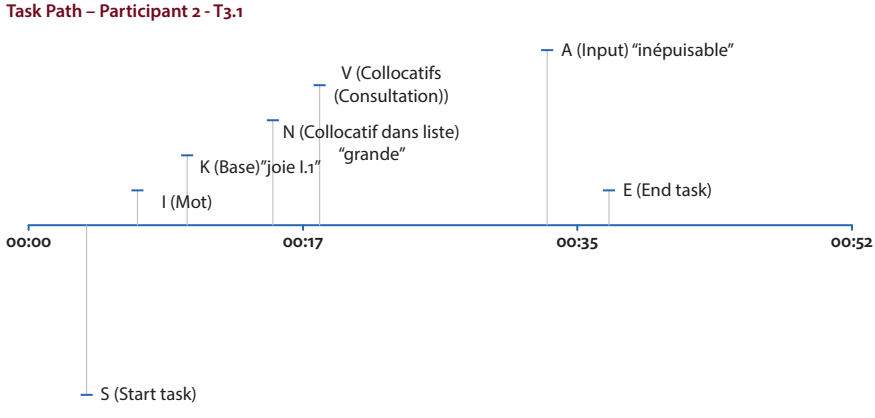

Figure 7.3 Task path sequence of a participant searching for a collocate in a dictionary

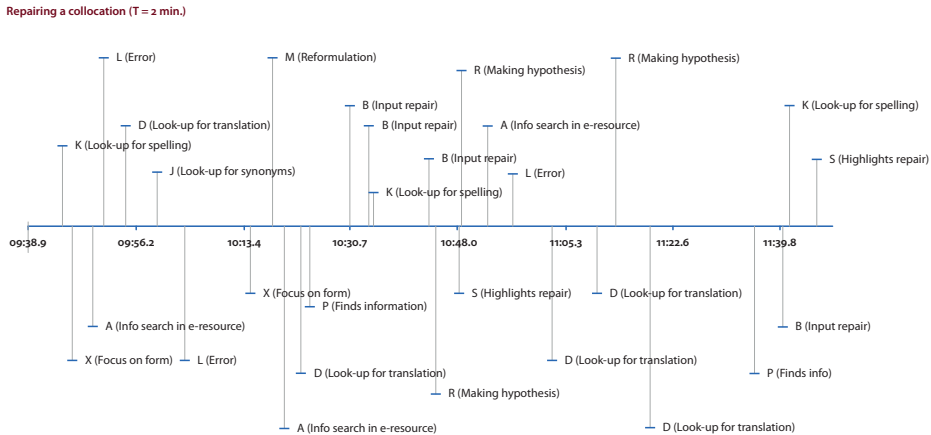

Figure 7.4 Action sequence showing an attempt by a learner to repair a collocation

this two-minute process, 30 actions were recorded. Figure 7.4 shows this action sequence.

Lifting the veil on hidden processes

The detailed step-by-step records provided by the VSC data helped bring to light aspects of students' literacy practices which have in the past traditionally remained invisible and thus unnoticed and/unverifiable in the absence of VSC (Geisler & Slattery, 2007). This ability for VSC to lift the veil on students' processes represents a key affordance of this tool.

In the case of study 1, for instance, one could see how language learners navigated their way to the various choices made, more or less efficiently, in electronic dictionaries. As they moved from one micro-task to another, some students learned to optimize their search paths in the dictionary whereas others did not.

Similarly, in study 2, it was interesting to note the role that students' L1 actually played in their L2 composition processes. Whereas these students' final drafts were, by the very nature of the task, completely written in French, VSC data allowed one to note how often writing in the L1 had in fact helped scaffold this L2 writing (e.g., a student wrote her first draft of her text in English before translating it into French).

This type of data (and the insights that can be generated from its analysis) is well suited for ethnographic studies of digital literacies that highlight the value of the direct observation of students' literacy practices and LCI. It also makes important contributions to the field of CALL ergonomics (see Chapter 2, this volume) by allowing focus on the quality of the user-task-tool interactions at the computer, on the mediations with the task and the tools and on the various choices, paths (optimal, efficient, etc.) students make and take as they use tools for L2 writing.

VSC as a means of exploring efficiency, effectiveness and user attitudes

Another advantage stemming from the detailed maps and portraits offered by VSC is that one can focus on the efficiency, effectiveness and user satisfaction experienced by users as they interact with texts in a digital environment. These criteria reflect those standardly used for usability tests to measure the quality of user-task-tool interactions (see Chapter 2, this volume). One can look at efficiency as a measure of efforts (calculated as a function of actions taken over a defined time period). For example, in study 1, as detailed above, parameters of efficiency

were included as coding annotations for the VSC data collected. These parameters coded the degree of efforts expanded by students when dictionary functions (such as performing a keyword search, looking up a synonym) were solicited by a learner during the task process.

Investigations of students' efficiency can also be used to explore the notion of *errors* made by users as a result of their task-tool interaction. In the case of study 1, for instance, such errors occurred in the LCI corpora, emerging from the usability tests with the online dictionary. They highlighted problems related to its interface *accessibility* (difficulties finding/using a function of the dictionary) and its content *comprehensibility* (difficulties understanding information provided by the dictionary, such as definitions), both having negative effects on its *learnability* (difficulties learning how to use the dictionary).

Errors, moments of struggles or transactions as students worked through the problem solving nature of composing their texts also emerged in study 2. In this case, these errors helped identify developmental aspects which need to receive particular attention in the design of writing pedagogy and the conceptualization of what students need to learn and the skills they need to develop in order to become good writers (e.g., many students need to be taught explicitly how to produce French accents on their keyboards or strategies for the effective use of grammar and spellcheck software, such as *Antidote*).

One can also look at effectiveness and the degree of user satisfaction/contentment associated with specific actions taken with a specific tool or achieved through the use of a specific strategy.

This can involve direct measures of effectiveness through objective measures of what can be seen on the screen (e.g., on-screen actions, task results). Hamel (2012) measured the quality and the quantity of the language output produced by language learners as they interacted with their dictionaries. A successful language output corresponded to an accurately constructed collocation, produced by a learner as a task outcome. Study 2 explored whether a student found an accurate way of expressing an idea after a moment of struggle in her writing was signalled by both greater than average pauses in her writing process and the interruption of text production to look up linguistic information in an online resource.

Effectiveness can also be investigated through users' self-reports (e.g., answers to questionnaires, interviews), data elicited to ask users to judge/comment on the degree to which they believe they have or have not been successful at achieving specific goals. This illustrates how data produced through VSC can also be analysed in conjunction with additional data sources to add to the richness of the accounts produced with VSC data.

In study 1, questionnaires were used to investigate learners' perceptions of the online dictionary used for the completion of a collocation task (Hamel, 2013). These questionnaires also investigated the feelings and judgments attributed by a student to the results obtained at the end of a task (for example, a high or low score, a positive or a negative comment given to a dictionary feature or a comment on the value of a personal performance). The questionnaires revealed that learners tended to underestimate their performance, found the task difficult and the dictionary essential for its completion – this, despite a high effectiveness score obtained by the majority. These findings corroborate Fischer's (2007) claim that there is often a discrepancy between observed and reported learner data.

Study 2 used interviews to ask learners to comment on various aspects of their writing. Questions, amongst others, explored students' degree of satisfaction with the texts they had produced and students' perceptions of the usefulness of the various resources consulted while writing. It was also possible to match VSC with stimulated recall interviews (Gass & Mackey, 2000). Students were asked to revisit and watch selected excerpts of their screen capture videos and to narrate their task processes and explain what was going through their minds as they engaged in the actions captured in the video. With this type of approach, the general goal is to elicit information about users' perception of a task, its realization and their feelings about what they are capable of achieving (Raby, 2005).

In study 3, both questionnaires and semi-formal interviews were used to investigate students' and instructors' perception as to the use of VSC as a pedagogical tool in their writing classrooms. It is also possible, as was done in the case of study 3, to ask students to engage in a reflective task (see more about this below), where students are asked to watch themselves again, reread the texts they have composed and comment in writing or, through the creation of a new VSC, on what they have noticed and learned about themselves as (L2) writers.

Additionally, students can be asked to record their thoughts at the same time as they complete a task and work on a computer (another type of task which emerged in study 3). This activity asks students to comment in a think-aloud fashion, which provides an aural track of the thoughts and ideas that accompany what occurs on screen. In one instance, this task was assigned to students who were working as a group, generating extremely interesting data on the types of interactions and discourse produced by students as they engaged in a text-planning activity.

Pre- and post-task questionnaires can also serve to gather information about the participants as well as to collect information about data, other than students' sense of satisfaction with the LCI tasks they have been asked to record with VSC. Demographic questions, questions about students' previous educational experiences and technology usage, as well as questions about their attitudes towards

their second language, are but a few examples of variables that can then be used to explore possible correlations with events and actions noted in the VSC recordings. As mentioned above, study 1, for example, showed that there was a strong correlation between task success and learners' prior experiences with a variety of other lexical resources.

The final element that can be used to help contextualize the events and actions seen in the VSC recordings includes the collection of any relevant textual materials connected to the digital texts captured through the VSC (e.g., copies of handwritten notes students use as they work on the computer, copies of the task descriptions handed out by instructors) and observational data in the form of field notes. In the case of studies 2 and 3, field notes and reports were kept as well as copies of course outlines, assignment descriptions and handwritten notes provided by participants in the study. This material provides valuable hints which can enhance the analysis of students' actions and can be triangulated with the various data sources mentioned above to produce detailed accounts and establish the relationships between learners' on-screen actions, their attitudes and backgrounds, as well as the context and resources associated with the specific literacy practices and CALL tools and applications being studied. This is well in line with an ergonomic approach to the analysis of LCI (see Chapter 2, this volume).

VSC and the ability to create new forms of corpora

Our research experiences with VSC and the richness of the data these projects produced suggest that there is great potential in VSC's capacity to produce rich audio-visual corpora of language learners and their educators as they engage in LCI tasks (i.e., composing a text, using an online dictionary, reflecting on a text, providing feedback to students). Indeed, a key affordance of the tool lies in the fact that while recordings produced by VSC can be analysed individually, these can also be collated and compiled to produce multimodal LCI corpora that allow for the cross-case analysis of individuals' literacy practices in digital spaces.

Such corpora represent new and exciting forms of empirical data which, once anonymized, could contribute to learner corpus projects that might be shared with others (see Chapter 10, this volume). The resulting database of observable processes could then be exploited to better capture the fluid and ever-evolving nature of literacy practices. It could be used in teaching interventions as well as for teacher training. Similarly, the corpus could become a source of valuable materials to be integrated into presentations, webinars and online tutorials and meetings.

VSC as a retrospection tool

Another key affordance emerging from our studies is the tool's potential to serve as an aide to retrospection (see Chapter 9, this volume). By allowing users to capture and later replay their interactions with the machine as they engaged in a task, VSC allows users to view these interactions in a more detached and reflective way than what is possible at the time one is actually completing the task. In this sense, the VSC recordings were labelled by one of the instructors in study 3 as a tool that can serve as a mirror offering new ways to view and understand their own behaviours and literacy practices. This instructor took full advantage of this affordance and encouraged her students to revisit their notes and texts, but also the VSC recordings which they had produced over the course of the semester, when studying for her course.

Within both research contexts as well as within the context of a classroom, VSC facilitates language learners' metacognitive awareness and strategic awareness. This retrospection affordance benefits the students/participants as well as the teachers/researchers who gain insights into students' developing knowledge and skills as they gain experience with a targeted LCI task.

VSC as an important and powerful scaffolding tool

A key affordance of this tool emerged from the work of Hamel, Séror and Dion (2015), focusing on the tool's ability to scaffold learners and enhance CALL pedagogy. The findings from this project highlighted the multiple and varied ways in which VSC can be integrated into the language classroom through the (re)design of L2 writing tasks.

At the start of the project, when discussing its aim and the potential applications of the use VSC has in L2 writing classrooms with instructors, time was spent brainstorming what a VSC-mediated L2 writing task might look like. This process took into consideration notions of syllabus design, course objectives and the nature of writing tasks previously assigned to students by all instructors present. Ultimately, the two instructors who participated in the study produced a number of tasks which integrated the use of VSC and responded to their personal needs and teaching styles.

The FLS instructor favoured VSC-mediated tasks that focused predominantly on text revision, aspects of the text genre and the desire to develop students' text agency. These tasks were designed to be completed as individual homework assignments in students' homes. The students' roles were to revise and assess their writing, reflect on revision and develop an awareness of themselves as writers.

For her part, this instructor saw her main role as being an *assessor* who provided feedback (evaluation, comments) on the text process and product as well as on the degree of agency and metacognition observed in students' reflections.

The tasks designed by the ESL instructor targeted specific components of the writing process, with objectives focusing on helping students experience and master subcomponents of the writing process, such as brainstorming, text planning and editing errors when revising. In contrast to the FSL instructor's tasks, his tasks were designed to occur within the classroom environment and took advantage of the fact that some of his classes were offered in a lab, equipped with computer stations. He favoured positioning the students in the role of *thinkers* when using SOM. Individual feedback focusing on the VSC recorded by students was not provided directly to them. However, the recordings were discussed in the class as a whole, although the actual videos were not shared or viewed by peers. Rather, students were encouraged to watch the videos on their own to help them reflect on their writing processes.

The ESL instructor further reinforced his focus on the writing process through the use of modelling. He presented the students with relevant text samples of his expected written outcomes and engaged students in peer work and editing so that stronger students might help weaker students by modelling optimal processes and strategies. Interestingly, he extended this modelling practice by asking an expert writer to produce a VSC, which could be shown to students as an example of how advanced writers complete writing tasks. This video clip served as an authentic, multimodal exemplar for the students, helping to reinforce the validity of the steps and processes promoted in his writing class.

In interviews discussing their experiences with VSC, both instructors noted that they had found VSC useful for monitoring, supporting and accompanying language learners as they worked independently through the various stages of writing associated with a specific task. Importantly, both instructors also identified the potential of building a database of their own students' VSC with the option (granted consent from students) of exploiting this small corpus for pedagogical purposes. Video extracts (e.g., action sequences, as seen above) might be chosen to illustrate best practice, common problems experienced by students and their solutions or to share with others resources that fellow language learners have identified and successfully used.

Instructors also commented on the ability to communicate with students in a multimodal medium that can be delivered outside the traditional context of the classroom. In their opinion, while integrating VSC into their classrooms did require transforming their teaching practices and a significant investment of time and energy to redesign writing tasks they had used in the past, VSC offered new and exciting ways of achieving the class objectives.

Whether it is for providing feedback, demonstrating the most effective way of looking up collocations in a dictionary or to illustrate in concrete and dynamic ways how students write, VSC offers a range of applications which can be used to support L2 literacy development. Such videos would be particularly useful in the context of courses offered online and in blended environments.

Conclusion

This chapter has illustrated the affordances of VSC and its role in the design of CALL research and pedagogy, drawing on examples of the use of VSC and its applications in three research projects.

Its affordances present a number of promising avenues to be further explored as researchers continue to discover ways to take advantage of the tools' documentation function as well as its dynamic, multimodal nature.

Our research has highlighted the potential of VSC for the investigation of computers and digital spaces, particularly the role it plays as a mediating tool which increasingly shapes the literacy development and experiences of users. Undoubtedly, these affordances play a role in helping shape what it will mean to teach digital literacies and to promote the competencies required of students, citizens of a modern, technologically connected world (Yi, 2014). Further work is needed to explore and document the full range of applications of VSC for research and pedagogy. As Levy (2013) has reminded us, a design-based CALL agenda should explore *usability, scalability* and *sustainability*. Hence, the integration of VSC should be carefully planned and scaffolded with training, and embedded in feedback. Creative and collaborative usage (sociocultural mediation), the development of communities of practice of teachers and learners experienced in using VSC, as well as technology experts, will represent important ways of further refining our understanding of the affordances of this exciting technology.

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