Writing in an electronic age: A case study of L2 composing processes

1. Research on the composing process

Uncovering the processes taking place as a writer produces text, either via pen and paper or keyboard and screen is an extremely difficult undertaking. Writers have the complex task of taking raw ideas and representing them on screen as a string of words with syntax, i.e., an undertaking that recursively mixes thoughts and mechanics (Roca de Larios, Mancho´n, Murphy, & Marin, 2008). Researchers of writing processes have the even more complicated job of breaking down the processes into understandable components that accurately reflect this deeply cognitive behavior. Fortunately, understanding of this process advanced considerably beginning in the 1980s when models (e.g., Bereiter & Scardamalia, 1987; Flower & Hayes, 1981) were first developed for grasping what takes place in the minds of writers who were composing in their first language (L1). The Flower and Hayes model (1981), for example, outlined three writing processes – planning, translating and reviewing – each of which was also further sub-categorized (see discussion below). When a writer is composing in a second language, however, these processes are compounded

because extra steps are needed to decode thoughts into language before text finally appears on the page or screen.

In order to understand the composing processes of both L1 and L2 writers as they construct prose, researchers have designed studies in which they ask writers to voice their thoughts in think-aloud protocols while being videotaped. During these sessions, participant writers usually complete their composing task in a single sitting using pen and paper. However, while such an experimental set-up is both convenient and necessary for controlling the composing conditions and conducting the protocols, the actual task at hand, i.e., an immediate written response to a generic prompt, tends not to reflect the types of writing normally performed in real life. A much more common scenario among university students is the research paper, which is more likely to be completed over a period of weeks while requiring research. This paper is also written in an electronic environment rather than with pen and paper replete with information from electronic sources. Because of these differences, the composing processes, including their associated time allotment may be considerably different from those that have been investigated in highly controlled situations using think-aloud protocols. Accordingly, the present study seeks to both explore

composing processes in a more naturalistic environment, as well as propose alternative methods for revealing their nature. Any differences in the composing process exposed by a more naturalistic study have the potential to shed light on new writing behaviors which in turn may suggest a need for change in pedagogy.

1.1. Understanding the composing process

Interest in the process of composing in a second language grew out of studies that explored the writing behavior of L1 students. Early studies by Emig (1971) and Perl (1980) revealed that the discovery of meaning through the act of writing was not a linear process, but a recursive one in which "writers go back in order to move forward" (Zamel, 1982, p.197). The seminal model proposed by Flower and Hayes (1981) revealed composing as deeply cognitive behavior requiring many sub-processes within three main phases – planning, translating and reviewing. Planning includes the generation of ideas, organizing information and setting goals. Translating, not to be confused with translating from one language to another, requires writers to put their ideas into words and sentences including all that this task entails, from obeying rules of grammar to controlling motor skills for

hand-writing text. The third phase, reviewing, covers the evaluation of the text and the subsequent reorganizing, deleting and adding.

Led by studies on the composing process in the native tongue, research on L2 composing processes followed. Such interest is understandable because of the significant extra steps involved, as L2 writers at most levels need to literally translate their ideas from their native tongue into a second language. However, Zamel (1982; 1983) found the same recursive process existed among the more experienced L2 writers she surveyed, with pre-writing, drafting and revising characterizing the progression through to the final product. In a later study, however, Raimes (1985) found that unskilled L2 writers displayed a more complex profile, with the implication that lower level writers also have sufficient ability to discover meaning as they write. Nevertheless, subsequent studies suggested that skilled writers are advantaged over the unskilled in terms of metalinguistic analysis, i.e., thinking about what language to use (Cumming, 1990), and their allocation of time to the various composing processes (Roca de Larios, Murphy, & Mancho´n, 1999; Sasaki, 2000; Sasaki and Hirose, 1996).

Studies comparing L1 and L2 processes have tended to support the notion that fluency is negatively affected when composing in a second language (Silva, 1993) with fewer words written (Sasaki & Hirose, 1996) and more frequent interruptions in the formulation process (Roca de Larios, Mar´ın, & Murphy, 2001). Similarly, Roca de Larios, Mancho´n, & Murphy (2006) found that twice as much time was lent to formulation in the L2 than the L1. In fact, Wang and Wen (2002) found that sentence construction occupied two-thirds of the composing time spent by their L2 subjects. Further, when Roca de Larios, et al., (2008) examined how time was allocated to various composing processes, they identified three main practices that L2 writers typically perform when completing a writing task, planning, formulation, and revision – a result which appears to parallel the planning, translating and reviewing of the Flower and Hayes model (1981). Among these, formulation accounted for the bulk of time taken (from 62% for advanced writers to 81% for lower level writers) to complete the task at all proficiency levels. Meanwhile, "planning" accounted for a maximum of 13% of time for advanced writers, but only 1% for low level writers. Time allocation for revision ranged from 6% at the lowest level to 21% at the intermediate level with the advanced writers using 16% of the time.

This finding is particularly important for the present study because it sets a clear benchmark for the types of processes used by L2 writers against which comparisons can be made for a much more common writing scenario – a research paper written over a period of weeks. Accordingly, the present exploratory study seeks to answer two questions:

1) How is time allocated to different composing processes in a research paper from receipt of prompt to submission of product written in an electronic environment over a period of weeks?

2) What behaviors characterize each of the processes in #1?

2. Methods

Data from studies on the composing processes of L2 writers found in the literature have been derived from instruments such as think-aloud protocols (Cumming, 1990; Raimes, 1985; Roca de Larios, et al. 2006; Roca de Larios et al., 2008) interviews (Zamel, 1982), text analysis (Zamel, 1982), stimulated recall protocols (from video) (Sasaki, 2000; Sasaki, 2004), and direct observation (Pennington & So, 1993; Zamel, 1983). See Table 1 for a sample summary.

Table 1 here

While such instruments have proved effective for uncovering writing processes in highly controlled settings in a paper-and-ink environment, the present study, which operated in a more naturalistic setting, adopts a mixed methods approach principally employing qualitative methods (a student log, a retrospective questionnaire and interviews). Recording and tabulating the amount of time spent on each of the processes (see details below) accounted for the quantitative part of the study. The reason for using such instruments was related to the nature of the writing assignment which made real-time behavioral observation methods, such as think-aloud protocols, impracticable because the time between receiving the writing assignment and completing it took a period of weeks. Such a length of time and the variety of composing locales also precluded using other methods such as direct observation, keystroke logs (Miller, 2000), stimulated recall sessions (e.g., Lindgren and Sullivan, 2003) and videotaping because one of the distinctive requirements of the proposed study was to track the composing process as it took place in authentic situations, i.e., over a period of time, on multiple occasions and in multiple settings. In contrast, the type of writing tasks which lend themselves well to employing think-aloud and stimulated

recall protocols as well as keystroke logs are those which set a prompt with learners completing the task within a limited period of time while recording takes place. Such a method, however, does not explore and analyze the much more common writing scenario faced by EAP (English for Academic Purposes) learners in which a writing assignment is received and a completed research paper is submitted several weeks later.

2.1. Participant

In the studies noted above, as delineated in Table 1, sample sizes ranged from half a dozen participants to upwards of two dozen. While such numbers appear appropriate for using the methods described, the present study explores one student's behavior using different instruments which allow for the in-depth examination of composing processes more suited to case studies. The choice of this methodology was largely determined by the logistical impediments implied in the research questions, particularly the need to describe the writing process in a naturalistic environment (over a period of weeks in multiple settings). Duff (2008) notes, "choice of [research] method is…determined in large part by the questions one seeks answers to, the body of knowledge that already exists on that topic, the domain of inquiry and context, and the methods the questions lend themselves to" (p.viii). The present

case study method also dovetails with an exploratory approach which examines the feasibility of the procedures used (Yin, 2003). Additionally, the somewhat burdensome log-keeping, although less cognitively intrusive during the composing task at hand than think-aloud protocols, demands a cooperative participant, which again suits the case study approach. Four previous case studies on L2 writers show that this methodology can generate useful findings: Spack's oft-cited longitudinal study (1997) of a Japanese graduate student's reading and writing strategies, Johns's case study of a Vietnamese science student (1991) who had repeatedly failed an English competency exam and Yi (2007) as well as Yi and Hirvela's studies (2010) of the non-school writing practices of a Korean high school student.

"Andrea" was 23 years old at the time the study took place. She had recently completed a Master's in TESOL at a Hong Kong tertiary institute and was about to embark on an English teaching career at a local primary school. Her IELTS score was 8.0 (equivalent to the mid-600 range on the TOEFL paper test). Andrea described herself as an underachieving student who disliked English during her high school years. She repeated her final year of high school as her grades were too low for university acceptance. When she

entered university, she described herself as “below average” as a first year student; however, by fourth year, she was in the top 10 percent of her class as measured by her grades. As a Master’s student, her grades were at the B+ level which she claimed was average in her class. Andrea’s “average” profile along with her availability and willingness to participate were the three main criteria for her selection.

As for Andrea’s composing experience, she noted that writing in English was always her worst subject in school; however, she felt that she had improved considerably as an undergraduate, “but I still do not enjoy writing essays in English.” When Andrea was interviewed for the present study, she claimed that she felt more comfortable writing in English than her native Chinese. Part of the reason for this was that for the past several years, all of her assignment writing was in English. Another reason was that she felt less than proficient in using a Chinese keyboard.

2.2. Writing prompt

The writing prompt was decided via negotiation between Andrea and the author in a way which would best reflect a typical assignment undertaken by master’s-level students in the program she attended. Andrea collected several assignment prompts that she had received

in courses, such as Second Language Acquisition, but for which she had not written any papers when studying for her master's degree. Among these, she was allowed to choose one which interested her. The chosen prompt was "Write an essay supporting or critiquing Long's Interaction Hypothesis." Andrea later entitled her paper "Rethinking Long's Interaction Hypothesis (IH)."

Andrea was asked to write a 3000-word paper as if it were a term assignment for a credit-bearing course. She was told that both the researcher and one of her master's course teachers would read the paper and assign a grade to it and return it to her. She was also told to approach the assignment exactly as she would if she were taking a course for credit expending the same amount of time and effort. Andrea received financial compensation upon completing the task slightly after the three-week deadline. She was also fully informed of the study's purpose and that her real name would not be used.

2.3. Log, retrospective questionnaire and interviews

Logs are a well-established tool used in education as effective learning aids (Dolmans et al., 1999; McCarthy & Walvoord, 2008). McCarthy and Walvoord (2008), in particular, conducted a study of their students' composing processes using logs as the principle data-

producing instrument supplemented by interviews and audiotapes. The author has also used logs in studies for generating useful data (Helms-Park, Radia & Stapleton, 2007; Radia & Stapleton, 2008). Most recently, the participant student in Yi and Hirvela's case study (2010) produced useful data in an activity checklist similar to log entries. Logs, like diaries, bring access to the cognitive processes undertaken by students as they make decisions about writing content and mechanics that they encounter over time. Unlike the use of think-aloud protocols and direct observation during immediate-response-to-prompt studies, the logs are relatively non-intrusive (see Dornyei, 2006; Gibson, 1995) and perhaps the only method of accessing composing behavior as students write an assignment over a period of time in multiple locales. However, log-keeping is a demanding activity, so both rigorous training and motivation on Andrea's part were challenges that had to be overcome in order for her to accurately record her composing processes.

Before receiving the prompt, Andrea was shown a sample log to ensure she would include an appropriate level of detail and accuracy of her composing activities. Essentially, in her log she had to record all of her composing activities during each session in chronological

order with an indication of the length of time taken for each in as much detail as possible. Andrea was given the following sample framework in addition to the sample log:

1) Reading and Pre-writing, e.g., how you identify ideas and categories, library searches and searching for information on the Internet (keywords, search engine names, and links clicked on including non-textual information); sequencing information, goal-setting;

2) Selecting Information, e.g., copying hard copies and copying and pasting information from websites; reasons for including and eliminating information;

3) Drafting and Composing, e.g., comments on note-taking, vocabulary choice, sentence construction and organization; extent of use of electronic tools for composing; extent of use of copied electronic texts as models for composing;

4) Revising and Reviewing, e.g., comments on decisions about when idea generation was complete; comments on self-evaluation; extent of use of software, both prepackaged and Web-sourced for improving language mechanics.

After Andrea's first log-keeping session had finished, she viewed and rewrote her entries with the author for the purposes of recording her composing processes using language that accurately reflected the needs of the study. For example, Andrea was asked to elaborate on details of her online searching practices, her struggles with finding the right word, and the amount of text she deleted and rewrote, among many other composing activities. Although the log was the main data-gathering instrument, Andrea also completed an open-ended retrospective questionnaire and was interviewed three times, once each before, during and after her composing sessions.

2.4. Data analysis

Log entries were read through several times in an initial coding exercise (Richards, 2003). This entailed the development of provisional themes before the generation of codes, four of which were informed by categories in Roca de Larios, et al., (2008 p.36-37). Three of the seven codes from Roca de Larios et al. were eliminated because they related to procedural elements of think-aloud protocols, e.g., meta-comments, prompt-reading and task interpretation. Examples from Andrea's log are below each of the four categories and rubrics as follows:

Planning: Those episodes which involve the retrieval and generation of ideas, the establishment of connections between them, and the setting of goals.

"Thinking what to write next. Thinking whether or not I should suggest some reasons for that observation."

Formulation: Those episodes which indicate that the writer is trying to convert thoughts and ideas into language, with or without having to engage in problem solving.

1. …using online thesaurus to search for words meaning 'good', picked 'desirable'

2. Writing two versions of the sentence…deciding which I should use to describe the origin of the hypothesis

Evaluation: A process by which the writer assesses the efficacy of his/her pragmatic, textual, and linguistic decisions.

"Reading the part again before moving on…see if there are any better words I can use."

Revision: Those episodes in which the writer changes, adds to, or deletes previously written segments of different length.

> *1. Modifying and elaborating the transitions for each paragraph to make sure the organization is tightly hanged together.*
>
> *2. Wrote "helped obtained"…Deleted it…not satisfied…not vivid…used "secure" instead.*

A significant number of log entries could not be classified under these four categories however. These unclassified entries were first assigned to conceptual categories in an open coding process and then further passed through axial coding (Strauss & Corbin, 1998), whereby sub-categories were related to each other and subsumed into the following two core categories:

Research: Those episodes in which the writer sources, reads and/or copies information pertaining to the composing task at hand.

Searching for how Socio-interactionists view language learning among the journal articles I collected. Typing the keyword 'socio-interactionist, language learning' in Google search bar.

Collaboration: Those episodes in which the writer consults with others regarding the composing task at hand.

Talking to my friend online with yahoo messenger to discuss my introduction and what he thinks of it and how I can write it better

Once categories were established, a second rater was trained to code a portion of the items (as per Smagorinsky, 2008) as a reliability check. Using the categories and definitions below, the inter-rater reliability between two raters was 80% (agreement on 112 of 140 entries.

The resulting categories above served as a guide for deciding how to code the questionnaire and interview data. Each questionnaire and interview response was also coded under one of the six categories based on the content in Andrea's responses. Subcategories under each of

the six main composing activities above were then further generated using a similar coding process as above.

3. Results

Andrea spent a total of 49 and a half hours over a period of three weeks in three different venues (library, home and in-transit) writing her paper of over 4000 words which included 18 sources. Her log comprised 216 entries delineating at least that number of separate composing behaviors. The author and one other faculty member teaching in the same program as Andrea's independently graded her paper as if it were submitted as a term paper for a Master's level course. Both awarded the paper a B+. Neither was a former teacher of Andrea.

3.1. Research question #1

The time she spent on each composing behavior (research question #1) is shown below and in Figure 1.

Figure 1

3.2. Research question #2

The behaviors that characterized each of the six processes outlined in #1 were the focus of research question #2. These are delineated under their respective titles below. Quotations below are taken from the log, questionnaire and interviews.

3.2.1. Research

Log data revealed that Andrea's research behavior fell into three broad activities – searching, reading and copying (either by copying and pasting or typing out). Andrea's searches were largely performed using yahoo.com with her institute library's database being her second choice. However, on advice from the author during an interview halfway through Andrea's composing process, she switched to Google Scholar. Her keyword searches were usually confined to two to three words and resulted in many false leads which she claimed wasted her time. The cause appeared to be Andrea's poor choice of search engine and keywords, e.g., failing to use advanced searches in scholarly engines. While Andrea's references reveal that most of her sources came from recognizable journals or book publishers, she cited two sites whose academic rigor was questionable. One of these was an EFL blog/forum in which teachers are invited to share their views. The other

was a master's dissertation from a Chinese university. When the dubious academic rigor in these sites was pointed out to her, she claimed to be focusing on the content, without paying attention to the source of information, while believing them to be "journals."

Andrea's time spent reading had two main purposes: to gather information and ideas, i.e., the customary research task, and read for structural purposes, i.e., to better understand how to organize the sections of her paper and also how to express ideas at the sentence and word-level. Andrea's copying of materials was almost exclusively performed electronically with only one reference made to a session of paper copying.

3.2.2. Planning

The time that Andrea spent planning fell into three broad subcategories: 1) generating ideas, 2) deciding how to organize ideas, and 3) deliberating over audience reaction. The following quotes are illustrative examples of the three types of planning:

1) generating ideas

"Decided I should support the role of interaction in effective learning, and then argue against the universally assumed benefits." (log)

"There were times that I suddenly came up with an idea of how I write the literature review, or my arguments for my theory, and I would type it down in the same page and then cut and paste it on another page as another document." (questionnaire)

2) deciding how to organize ideas

"Instead of writing straight ahead, I [jotted down] the things I wanted to write first. And then I made a 'landscape' for my entire essay, listing down the parts/the structure of the essay and the things that I would more or less include in it." (questionnaire)

"Thinking whether I should use my own words to summarize what Long found…or just quote what he said…" (log)

3) deliberating over the audience reaction

"Thinking what the readers would argue, and my counter arguments." (log)

3.2.3. Formulation

Formulating thoughts into language encompassed several distinct behaviors for Andrea beyond the straight "translating" or "the process of putting ideas into visible language "(Flower & Hayes, 1981, p. 373). Andrea's formulation decisions at the word-level beyond

the typical "translation" included using online dictionaries and the built-in thesaurus as well as combing through published papers for parallel phrasings. Andrea spent a substantial amount of time stuck with writer's block, simply unable to come up with the word she wanted. This block also appeared when Andrea tried to form her sentences. One strategy she often used when forming her sentences was to write out multiple versions of the same idea and choose the best one. Another strategy she admitted to was borrowing sentences of published works and then changing a few of the words in order to avoid charges of plagiarism.

> "…for the introduction [and] the literature review, I copied and pasted several sentences from different journal articles, and then I first tried combining them together. I replaced the adjectives and the main verbs using Cambridge online dictionary…I rearrange the sentence structure and the word orders…simplified it a little bit so to make the sentence look more like my own. For some sentences I borrowed the adjectives and main verbs, and

> the sentence structures for some completely different sentences in my essay just to make it look more matured and better. (questionnaire)

A Turnitin check of Andrea's paper resulted in a "5%" match with no string of matched words longer than six, well within the bounds of acceptability.

Spell and grammar checkers acted as Andrea's constant composing assistant. Andrea claimed,

> When I was writing my essay, I kept correcting my spellings with the MS [W]ord spelling check (the red lines) since I usually rely on phonics to spell my vocabularies (and thus would have a lot of spelling errors). Whenever I see green lines, I would stop, right click the green lines to check what's wrong with my sentence, and then rephrase and restructure my sentences according to the suggestions or hints provided by the MS [W]ord until the green line's gone. (questionnaire)

Andrea added that she would go to considerable lengths to get rid of a green line even though she realized that the grammar checker was far from perfect as she sometimes noticed unmarked mistakes of her own. (Only four green lines appeared in her paper).

3.2.4. Collaborating

Roughly eight percent of Andrea's composing time (four occasions) was spent collaborating with a more experienced writer. This collaboration came in the form of advice following the electronic exchange of her drafts. Feedback from her collaborator on various versions of sentences helped Andrea decide which versions and wording to choose.

3.2.5. Evaluating

Andrea's log comments about her evaluative processes tended to focus on broader aspects of what she had written rather than specifics as encapsulated in the following remark: "Re-reading twice to confirm it gives the right feeling and good organization."

However, occasionally, Andrea expressed specific dissatisfaction upon reading a section as illustrated in the following quote:

"Reading the part again…wanting to say it's finished…but feeling something's missing. Thinking it's too irresponsible just putting the quotation there without explanation…what is it that you want the reader to get from that quotation? Thinking what to do."

These evaluative comments tended to be more frequent when Andrea was finishing a section and especially towards the end of her paper.

3.2.6. Revising

At very frequent intervals throughout Andrea's entire composing process she made comments about her revisions which operated at all levels of detail from the word- to multi-paragraph-level. The examples below illustrate this.

"Reorganizing the sentence structure, finding synonyms to replace the adjectives and the verb. Corrected my spelling and sentence structure with the help of the MS [W]ord grammar check." (log)

"Reading the sentence…adding 'descriptive' before 'statistics.' Replace 'regarding' with 'concerning,' replace 'next' with 'succeeding'." (log)

In the retrospective questionnaire, Andrea wrote about her frustrations.

> "I deleted a HUGE amount of text. The amount that I deleted was almost as many and as long as the length of the essay itself. This was actually the most frustrating part when writing an essay, because I kept deleting what I wrote. I tended to write several versions for each sentence (with different sentence structures/wordings) but I could not decide which one was better. I kept thinking there would a better way to link my ideas in that paragraph in a more organized, comprehensible and concise way, and that the language could be more academic or matured. It was like I could not really deliver what I meant. Sometimes I was very indecisive of what to write first, and what vocabularies I should use." (questionnaire)

4. Discussion

The purpose of this study was to describe how one L2 writer allotted time to composing processes as she wrote a research paper over a period of weeks largely in an electronic

environment. Because studies of the composing processes of writers have almost exclusively taken place in highly controlled experimental environments with participants writing with pen on paper, the present case study attempts to set a benchmark as well as suggest a methodology for further studies in more naturalistic situations.

What appears significant, although perhaps not unexpected, is the remarkably different time allocations of composing behaviors in the present study compared with previous ones. The present study reveals a much reduced allocation of time to formulation (33%) when contrasted with other L2 studies, e.g., 62-81% (Roca de Larios et al., 2008), 69% (Roca de Larios et al., 2001), two-thirds (Wang & Wen, 2002), and those in L1, about 50% (Kellogg, 1987) and 72% (Roca de Larios et al., 2001). Given that Andrea was an advanced level user of English, her lower allotment of time to formulation is expected as per findings in the L2 studies above; however, such a low allotment suggests that in naturalistic contexts other composing behaviors take up substantial portions of time. Chief among these was "research" accounting for close to a quarter of Andrea's time. This behavior was not included in any of the other studies mentioned here due to the nature of their procedures. However, research, i.e., searching, reading and copying, are integral to the idea-generating

process which leads to the planning and formulation of a written product. Such being the case, studies on composing processes need to integrate this major component into the composition formula.

The inclusion of 'research' as a category arouses the link with the macro-level processes explored by Prior (1998) and Tardy (2009) whose thick descriptions of graduate students taking part in longitudinal case studies uncover the complexities of the writing process over lengthy periods of time. These complexities, which include elements such as the writers' understanding of the genres in which they compose, are reminders that the writing processes described here account mostly for real-time composing, while there is an unseen wealth of schema behind the words, syntax, ideas and organization of any written text.

While it is clear that social factors interact with the production of texts (Riazi, 1997), electronic communication may be even further enhancing social influence. Another behavior unaccounted for in previous studies was "collaboration." On four occasions, Andrea consulted a person she deemed qualified to comment on her writing which presumably led to an improved product. Certainly, collaboration is not a new kind of behavior among L2 writers (de Guerrero & Villamil, 1994); however, electronic means of

communicating and sharing files may have facilitated this activity to an extent where advice from peers and mentors is adding a new dimension within the socio-cognitive sphere of influence and is worthy of inclusion as an integral part of the composing process.

As for "evaluation," Andrea's time spent in this activity, (6%), as opposed to 1-4% in another study (Roca de Larios, et al., 2008) may have reflected her ability to better manage time over a period of weeks when compared to the severe time constraints dictated by experimental conditions in other studies. This flexibility of temporal management (over a period of weeks) probably accounts for the much greater amount of time given over to "planning" as well. Other studies (see Table 1) which have used experimental procedures operating under time constraints leave little opportunity to plan, e.g. 1-13% (Roca de Larios et al., 2008). On the other hand, Andrea's 18% allotted to planning was such a significant portion of her composing that it could be broken into subcategories. Two of the three of these (generating ideas and deciding how to organize ideas) bore a similarity to Flower and Hayes's seminal study (1981). The third, "deliberating over the audience reaction," likely reflected writing instruction received by Andrea during university highlighting discipline-specific genre approaches to writing.

Although 11 percent of Andrea's time was spent revising, this number is actually below the percentage (16) used by advanced level writers in the study by Roca de Larios et al. (2008). This lower percentage may be explained by the great frequency of occasions that Andrea used tools such as the grammar checker, thesaurus and online dictionaries, which could have increased the efficiency of her revising. In other words, new tools may have reduced the amount of time she spent in some processes leaving more time for others.

4.1. Electronic shortcomings, strengths and implications

Despite Andrea's frequent application of electronic tools, her occasional substandard use of new media and resources suggests that new tools and resources come with caveats which in turn points to several pedagogical implications. Beginning with researching skills, Andrea displayed only rudimentary knowledge of keyword searches, often using a poor choice of words. Her use of a generic engine, yahoo.com, was also particularly worrisome. Once told about Google Scholar mid-way through her composing, she switched to this engine and used it exclusively thereafter. Similarly, the lack of rigor at certain websites she had chosen escaped her notice resulting in citations in her paper that did not meet academic standards.

Such substandard approaches to sourcing appear widespread among students (Stapleton & Helms-Park, 2006; Wang & Artero, 2005) indicating a need for basic researching skills built in both as part of the taught curriculum as well as the feedback.

Despite Andrea's sometimes casual acceptance of a dubious source, she also displayed a strategic use of web sources. In particular, she visited Wikipedia as a "first stop source" for getting a general idea about her chosen topic (but not citing it) during the early stages of her research. While even Jimmy Wales, the founder of Wikipedia, discourages the citing of Wikipedia articles by students in their papers, he does encourage its use for basic overviews of a subject (Wired Campus: 2006), and this strategy appears to have merit. Rather than the unmitigated condemnation of Wikipedia as an academic source often espoused in university classrooms, instructors may consider encouraging a strategic use of such online sites as first-stop sources.

Andrea's use of electronic tools while formulating text displayed some interesting contrasts with previous studies. Roca de Larios, et al, (2001) discuss "lexical searches" (p. 516) referring to a cognitive hunt for a certain word to fill a slot in a sentence. In Andrea's case, this cognitive hunt was often replaced by her use of the thesaurus. Likewise, Andrea was a

heavy user of spell and grammar checkers to the extent that she may have overused the grammar checker given its tendency for false negatives (Buck, 2008; McGee, & Ericsson, 2002). While it appears to be an overstatement to claim that the "grammar check confuses much more frequently than it helps" (Buck, 2008, p. 409), clear direction from teachers about the strengths and weaknesses of this tool appear necessary. Such a directive also applies to the textual borrowing or "paraphrasing" (Keck, 2006) or the patchwriting (Pecorari, 2003) employed by Andrea. Certainly, some of Andrea's sentences would fall under Keck's term "Near copy." Again, rather than instructors issuing blanket instructions condemning plagiarism, more nuanced advice that draws attention to borrowing strategies is needed which clearly delineates the difference between paraphrasing and plagiarism.

A larger point here is that the cognitive energy normally used in a non-digital environment for lexical searches and formulating spelling and grammar was at least partially replaced by Andrea's use of electronic tools and her manipulation of borrowed text. If Andrea's example is typical, the present electronic environment used by most writers may be creating a shift in how cognitive resources are allocated. The former raw "translation" of ideas into language (in the Flower and Hayes (1981) sense) is possibly being replaced by a more

strategic process that has writers utilizing multiple tools and resources for reaching their textual goals. In fact, Andrea did not use all the tools available to her that have been shown to enhance L2 writing such as concordancers (Gaskell & Cobb, 2004; Hafner & Candlin, 2007; Lee & Swales. 2006; Sun & Wang, 2003), corpora (Flowerdew, 2002; Liu & Jiang, 2009), corpus consultation (O'Sullivan & Chambers, 2006) and Add-Ins (Milton, 2006). As tools such as these become more powerful, composing processes may continue to shift with a concurrent need for instructors to keep abreast.

4.2. Limitations

As with any case study, the findings here cannot be generalized beyond the individual in question. It bears noting that writing is "locally situated, extensively mediated, deeply laminated and highly heterogeneous" (Prior, 1998, p. 275). Indeed, the context, level, native language, background and even character of the participant were all highly distinctive. Andrea was very fastidious about wording and phrasing and often labored over her choices for lengthy intervals. Such a characteristic is not possessed by all or even a majority of writers. Although this paper describes the methods used as naturalistic, in fact, Andrea wrote considerably more words in describing her composing processes in her log

(in real time as she was composing) than she wrote in her paper. Such a heavy task certainly could have impacted Andrea's processes. Questions also remain about how accurately she described these processes. The level of detail in her logs sometimes varied as it is very difficult to describe every step and thought while one is composing. Indeed, any technique which imposes constraints on cognitive processes (in this case, interrupting the flow of normal behavior by requiring log-writing) is bound to influence the outcome. This issue is not unlike the concern brought up by Smagorinsky (2001) with regard to think-aloud protocols. Leaving aside whether thinking aloud interferes with composing processes, Smagorinsky points to Vygotsky's claim that "thought is never the direct equivalent of word meanings. Meaning mediates thought in its path to verbal expression" (Vygotsky, 1987, p. 282). Such a claim reveals that caution must be taken when interpreting and making hard conclusions about any composing processes revealed through language as this study and most others have done. In the end, in order to bypass the reliance on self-described efforts using logs and think-aloud protocols, perhaps only physiological techniques such as neurological measurements of blood flow (fMRI) can provide more accurate descriptions.

Another major concern was whether Andrea's composing accurately emulated the

conditions experienced by students writing research papers. While it is true that her conditions were superficially different, Andrea did express feeling stress before the deadline as well as concern for her final grade and requested an extension of several days in order to improve the discussion and conclusion. Thus, Andrea, like most students, experienced both the stress of a deadline and motivation to get a high grade, arguably the two biggest issues for student writers. Moreover, in the end, she wrote 1000 more words than assigned.

The classification of data was another area of concern. While the categories and subcategories described above may appear straightforward, the reality was much cloudier. In effect, distinguishing between formulating, evaluating and revising was challenging because the three often overlapped with two of the processes happening simultaneously. During Andrea's composing process she would sometimes suddenly stop composing, and delete, and then revise in the middle of a sentence; yet these behaviors had to be categorized differently. As noted by Roca de Larios et al, (2001), differentiating between processes is sometimes difficult and can best be overcome by a continuous refining of definitions. From a broader perspective, the difficulty experienced in distinguishing among processes only serves to underscore the complexity and recursion that exists as text is

generated.

5. Conclusion

In ancient times, the transition from using bronze chisels for carving hieroglyphs on clay to reed brushes and ink for drawing characters on papyrus must have been momentous. Carving specialists must have given way to new experts who could convey ideas in symbols much more quickly with fingers deft in different ways. The composing processes of the authors able to make the switch from clay to papyrus probably witnessed significant change. The few literati surely appreciated the efficiency and portability. As for the composing process, perhaps the increased speed at which symbols could be drawn cognitively taxed formulation when compared with the leisurely carving of clay. We can only speculate.

Likewise, the present decline in the teaching of cursive writing (Breen, 2009; Hallows, 2009) with the concurrent transition to an electronic composing environment may be equally momentous. As Microsoft announced upon the demise of their online encyclopedia, Encarta: “People today seek and consume information in considerably different ways than

in years past" (Stross, 2009). A similar comment may be made about the cognitive processes used to generate and express ideas in written language.

The present study has taken the case approach using a log, questionnaire and interviews and demonstrated that such methods may be used for following the composing process over time. Future studies into the composing processes of writers may wish to employ larger samples using different methods. Whatever the methodology, efforts should be made to capture those processes in a way which best reflects how authors compose in real-life situations that appreciate the context, time and technology as they are presently used.

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