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Interruptions in chat

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The research on text-based synchronous computer-mediated communication (SCMC), while generally acknowledging the potential benefits afforded by the medium's capacity for extensive self-repair, has done little in the way of exploration of the nature of such text. Indeed, until quite recently, output logs have been favored almost exclusively at the expense of richer records of the interaction that can better account for this deleted text. Another basic aspect of SCMC interaction is the occurrence of interruptions initiated by one's interlocutor during the message composition phase. The possible effect of these interruptions on the chat interaction, however, has again been largely ignored in the literature. This study examines the relationship between these interruptions and deleted text as well as the effect such interruptions have on the subsequent output produced by learners.

Keywords: CALL; synchronous computer-mediated communication; interruptions; deleted text; interaction

I. Introduction

There has been a recent call in the literature on computer-mediated communication (CMC) for computer-assisted language learning (CALL) researchers to account better for deleted text that is typed but not sent during chat interaction. Such text has been referred to by O'Rourke (2008) and Smith (2008) respectively as *pre-send revisions* and *CMCovert repair*. Accounting for this type of text is especially important for explorations of second language acquisition (SLA) in a CALL environment. Essentially, this position is grounded on the notion that text that is typed and subsequently deleted before being sent is important from an interactionist approach (IA) to SLA, since it reflects an important, yet regularly overlooked, portion of a learner's output – a key element in the IA. At the same time, this element of deleted learner output during chat embodies an additional context for examining processes deemed crucial for second language development including noticing, uptake, and self-repair. The present study is a first step in answering this call.

Output

Modified or pushed output (Swain, 1985, 1995, 2005) is a fundamental construct in much of current SLA theory (Izumi, 2003; Shehadeh, 2002; Swain & Lapkin, 1995).

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Swain's comprehensible output hypothesis (1985, 2005) argues for the importance of learner output in second language learning, suggesting that

> learners need to be pushed to make use of their resources; they need to have their linguistic abilities stretched to the fullest; they need to reflect on their output and consider ways of modifying it to enhance comprehensibility, appropriateness, and accuracy. (Swain, 1993, pp. 160–161)

Learner output may enhance the noticing of one's own errors, provide opportunities for contextualized and meaningful target language (TL) use and allow learners to test out hypotheses about the TL. Pushed output also helps learners move from a semantic to a syntactic analysis of the TL. Essentially, then, pushed output and the internal and external feedback that often accompanies it help learners to notice the gap in their existing interlanguage knowledge (Swain & Lapkin, 1995).

Output in synchronous, computer-mediated communication (SCMC)

CMC has been argued to be beneficial for SLA since it seems to lead to a heightened quality and quantity of production of learner output (Beauvois, 1998; Kern, 1995; Kitade, 2000). Blake and Zyzik (2003) suggest that the demands of electronic chatting seem to force participants to produce the target language (pushed output), offering the Spanish heritage speakers[1] in their study a chance to expand their grammatical, textual, illocutionary, and sociolinguistic competencies.

Beyond fostering pushed output, however, there is also an indication that the text-based CMC medium can amplify students' attention to linguistic form during production (Blake & Zyzik, 2003; Pellettieri, 1999), offering learners sufficient opportunity to *notice* lexical and grammatical features in the input and their own output. Two features of the text-based CMC medium in particular may be responsible for fostering attention to linguistic form: the slower pace of turn-taking (relative to spoken interaction), and the enduring visual record of the chat window. Compared to spoken interaction, the pace of a text-chat conversation is slower; chatters cannot type as quickly as they can speak, and chat clients typically support a protracted delay between completed turns (Sauro, 2009). This delay furnishes language learners increased time both to plan and produce their target language output (Payne & Whitney, 2002), potentially allowing learners the time needed to attend to and produce developmentally more advanced target language structures that require greater control. Coupled with the visual record of their immediate output captured by the chat window, this increased production time may allow learners enough time to attend to and repair errors or inconsistencies in their TL output.

As a result of the slower pace of turn-taking and the visual record of the interaction, CMC may foster more complex and accurate production and may consequently help facilitate a higher quality interlanguage than would occur in a non-electronic environment (Pellettieri, 1999). Though this has yet to be tested empirically, research on planning time and L2 performance has found an advantage for increased on-line planning time (i.e. within task planning time such as that supported by the slower pace of CMC) on the complexity and accuracy of learner output (Ellis & Yuan, 2004; Yuan & Ellis, 2003), suggesting an advantage CMC may hold for interlanguage development.

Deleted text as output in SCMC/SLA research

CALL/SLA researchers who are interested in the role of output on SLA should also be interested in the occurrence of deleted turns – that is, text that learners type and choose not to send – since this forms an integral part of the output. Although an important benefit of pushed output is eliciting external feedback from one's interlocutor, when focusing on the internal feedback generated by pushed output in a CMC environment it seems that the potential benefits of noticing the gap have more to do with *creating* a message in the first place rather than actually sending it.

Justification for study

The current study uses a portion of the data reported in Smith (2008), specifically, the complete chat interaction data and video screen record for all participants (n = 23) for one complete task from that study. Smith argued that in order to truly evaluate the nature of chat interaction, one must capture and account for text that is typed but deleted before being sent, as such a record has implications for our understanding of the role and nature of pushed output as well as self-correction or repair in the CMC environment.

In addition to accounting for deleted text, the approach and coding scheme outlined in Smith (2008) pinpoints the occurrence of ''interruptions'': those messages from an interlocutor that appear on one's screen while one is composing a message. Although it seems reasonable to expect that these interruptions may affect the quality of the output of the composer in some way, this question was not addressed explicitly in Smith (2008).

Assuming for a moment that *when* and *why* learners delete text is not random, the overarching question – indeed the one explored in this paper – becomes what affects whether or not one deletes text already typed? The working hypothesis at this early stage of inquiry into this question is that ''interruptions'' by the interlocutor influence the occurrence of deletions, and, therefore, the output in general of learners in a task-based L2 SCMC environment. These ''interruptions'' are, after all, one of the chief reasons for the noted lack of turn adjacency in chat interaction. It should be pointed out that when we talk about deletions we are referring largely to text that until recently has not been considered in any principled way in the CMC/SLA literature. The purpose of this paper is to move beyond simply accounting for this text/output and delve more deeply into the nature of this hitherto neglected piece of the puzzle.

Research questions

The overarching research question is the following: What is the effect of interruptions from the interlocutor on (1) *When* one chooses to delete typed text; and (2) The *nature of* what one deletes? Of course, to really get at this question we need to operationalize what is meant by *when* and *the nature of* what one deletes.

We operationalize the *when* in this case in terms of *when* the interruption occurs in relationship to the quantity or amount of text already typed (but not yet sent) in a particular message. We call this variable *location*. We operationalize *the nature of* what one deletes in terms of *linguistic complexity* and *lexical richness* of the typed text.

The following specific research questions were posed:

(1) Does the location of an interruption have an effect on whether one deletes text in progress or not?
(2) Do interruptions from one's interlocutor have an effect on the linguistic complexity and lexical richness of deleted text and transmitted text?

II. Methodology

Participants and tasks

As mentioned above, the data from one task of the larger study reported in Smith (2008) were used for further examination. This larger study explored the use of self-repair among learners of German in a task-based SCMC environment. The rationale for using the complete data of one task from this earlier study was that this particular task was found to have generated an extensive amount of task-based written negotiated interaction. This allowed for a broad data source, which was important to have since we intended to extract specific aspects of this interaction for examination and comparison. A more modest data source may have yielded too few examples of the relevant elements of chat interaction. Data from this task consisted of 23 usable chat and Camtasia records of beginner-high level learners of German as a foreign language. There were 12 dyads that completed the task; however, one participant experienced technical problems of some sort and did not initiate the screen capture software correctly, thus resulting in the odd number. These students participated in this study as part of their regularly scheduled German language course at a major southwestern university in the United States. In the larger study, students were required to meet once every other week in the foreign language micro-computing lab over the course of the semester. All students were undergraduates and all were native speakers of English. None were German majors. Their proficiency level and placement in the German sequence was determined by an in-house online placement test. All participants were characterized by the instructor as roughly at the ACTFL[2] novice-high proficiency level and were familiar with the chat function in Blackboard, a learning management system used extensively on this campus. Each German course from which the participants were drawn had its own Blackboard site, which students were required to interact with regularly for class. An additional separate and specific Blackboard site was created for this study.

Participants completed one training session prior to data collection to ensure they were familiar with the general task and procedures. This training session introduced and provided guided practice with the chat function Blackboard Chat since it could not be assumed that learners were familiar with this specific aspect of Blackboard.

Materials

The current task was a sequential ordering task, a type of jigsaw. As with all of the tasks in the larger study, this task type was chosen because of its structural requirement of two-way information exchange by participants who are striving to reach a convergent goal (Pica, Kanagy, & Falondon, 1993). Such structural

requirements have been shown to elicit a high degree of negotiated interaction among learners in both face-to-face (Pica et al., 1993) and CMC environments (Smith, 2004). The task provided each learner with a task sheet that contained four different color stills from a two-minute dramatic video clip that corresponded to the week's assigned course content. The stills were such that a logical order was not discernable simply by examining the photos alone but quickly and easily sequenced upon viewing the clip from which they were taken. Learners were instructed to describe their series of four pictures to their partner – who had a different set of four stills taken from the same video clip – and collaboratively arrive at a proposed correct and logical ordering for the complete series of eight pictures total. After the pairs had a solution, they were instructed to view the short video clip and then reconvene to evaluate their solution/sequence and make any changes before proposing a final sequence/solution.

No specific time limit was placed on students once they began the task. However, given the length of the class, participants realistically had about 40 minutes to complete it. All students worked collaboratively online with a partner. Each participant was given a task sheet labeled A or B. Each task sheet contained a series of four color stills in random order. All those holding task sheet A were grouped together and separated from those students in group B. This was done in order to reduce the chance that any participant would gain visual access to their interlocutor's (partner's) task sheet. Participants interacted with one another via the chat function in Blackboard and were paired under Blackboard's communication tool, Blackboard Chat.

III. Data collection and analysis

Capturing the interaction

The dynamic screen capture software Camtasia 3 recorded exactly what appeared on each participant's computer screen in real time. The Camtasia files were recorded to a networked drive and copied by one of the researchers for later analysis. The chat logs of these interactions were saved automatically in Blackboard.

Coding the interaction

Hard copies of the chat transcripts were converted to individual MS Word documents. One copy of each chat transcript was renamed in preparation for coding the interaction with the screen capture. These versions are referred to as the video-enhanced chatscripts. The video-enhanced chatscripts were coded using the procedure outlined in Smith (2008) (see Appendix 1). Each segment of text from these coded chatscripts was then placed into one of five categories. These categories were the following: (1) pristine text; (2) deleted text; (3) post-deleted text; (4) post-deleted, deleted text; and (5) pre-deleted text. Interruptions from the interlocutor were also coded in a separate column. The precise location of all interruptions was numerically marked reflecting the line of text that the particular interruption occupies. For example, if student A's line 5 on the chat transcript "interrupted" a message being typed by student B, then the symbol [5] would appear on the chat transcript of student B at the precise point that line 5 appeared on student B's screen. Figure 1 below shows an example of such coding. A description and illustration of each category of text follows below:

SCMC chatscript

1. Kade: ok das ist so wie photo D von mir 1:08:57

2. Derek: Die menner mit dem ~~Rose~~ ros Hemd ist die ~~T~~ Zetiung [1a] [zu] halten [+]. 1:09:23

3. Derek: die manner sind look wie sagt man ~~looki~~ to look at? 1:10:12

4. Kade: shen 1:10:37

5. Kade: sehen** 1:10:40

6. Kade: oder sieht etwas an 1:10:50

7. Kade: ok im welches photo nehmt den mann mit der rosa hemd die zeitung 1:12:14

8. Derek: die man~~ne~~ [6a] ~~e ist an a~~ sie[~~g~~]~~t ht~~ [-] ~~e~~ ~~die~~ der Man in der ~~Rose hemd~~ rose Hemd

is~~tt~~ sh~~ieg~~ht an~~d~~ dieser man mit dem blau Hemd.[7a] 1:12:15

Figure 1. Coding interruption in the chat data.

Pristine text (PT) was a complete stretch of text that contained no deletions of any kind. Such text was written from beginning to end without any self-corrections or alterations and sent to the interlocutor (e.g. Line 1 in Figure 1). Pristine text is not necessarily error-free, however.

Deleted text (DT) was text that never appeared on the printed chat transcript one would typically print out after saving a chat interaction to file (see ~~Rose~~.in Line 2). This text was captured by examining the Camtasia video files of the chat interaction in a line by line fashion.

Post-deleted text (PDT) was text that learners typed immediately following any deletions/corrections they made (e.g. "ros Hemd ist die ..." in Line 2). We counted as PDT text that started immediately after a deletion/correction and ended with sentence-ending punctuation, or the sending of the message.

Post-deleted, deleted text (PDDT) was PDT text that was subsequently deleted (e.g., the second "die" in Line 8). A more detailed discussion of this category follows in the Data analysis section below.

The *pre-deleted text* category was developed simply to account for all of the text written by an individual. Since *pristine text* required that there be absolutely no deletions/corrections in a given stretch of discourse, the *pre-deleted text* category was needed in order to code and account for text which came immediately before a deletion/correction in the same turn. The *pre-deleted text* category was not used explicitly in the data analysis.

IV. Data analysis

Data coding

Because of the unique nature of the deleted chat interaction data examined here, two separate comparisons of this data were required. Occasionally text was at the same time "post-deleted text" (PDT) and "deleted text" (DT). This presents a coding dilemma when text that is "post-deleted" in nature is subsequently deleted (post-deleted, deleted text, or PDDT). One solution to this problem was described in Sauro and Smith (2008) and will be briefly outlined here. Essentially, we conducted two

separate levels of analysis of the data. The first level of analysis is referred to as the *deleted text focus* and the second level of analysis the *post-deleted text focus*. In the deleted text focus we coded and quantified all deleted text and assigned it to the *deleted text* category irrespective of whether this text could/should also be coded as *post-deleted deleted* text or PDDT. Thus, in this analysis, only post-deleted text that was not then subsequently deleted remained in the PDT category. Any text that was typed and then subsequently deleted, no matter when these deletions occurred, was coded as deleted text.

In the *post-deleted text focus*, all text that was initially assigned to the PDT category remained there irrespective of whether it was subsequently deleted (PDDT). In this way, we were able to avoid any overlaps in the statistical comparisons of the data, since we conducted two independent statistical analyses.

Interruptions

The coding scheme described in Smith (2008) outlines an approach to accounting for interruptions. It locates the interruption clearly in the chat transcript itself, allowing one to see more precisely the flow of the chat interaction as it occurred. One benefit of this approach is that one may see in text form the sequential relationship between interruptions and subsequent deletions when they occur. Thus, we further segmented the chat data according to whether any given segment of text co-occurred with an interruption or not.

V. Results

First it is necessary to establish how often learners delete text when an interruption is present. Table 1 below shows the overwhelming preference for learners to *not delete* text upon being interrupted during their composition of a chat message. Of the 147 interruptions in the data, only 44 or about 30% of these resulted in a subsequent deletion in that same line of text. The initial question we had to address, however, was whether the act of deleting text after one has been interrupted was purely a feature of individual style or not. That is, it could be that upon being interrupted while composing a chat message, some learners are ''deleters'' and others are ''ignorers.'' If this is not the case, then further exploration of circumstances under which learners do in fact delete is in order. To test this possibility we calculated the percentage of post-interruption deletions for each learner; that is, the number of times one deleted text immediately following an interruption was divided by the total number of interruptions for that learner. Next, in anticipation of conducting a one sample Wilcoxon Signed Rank Test to answer this question, two tests for normality were conducted. The results from a D'Agostino & Pearson omnibus normality test ($K2 = .739$, $p = .691$), and a Shapiro-Wilk normality test ($W = .954$, $p = .354$) showed that the percentage of post-interruption deletions data were symmetrically

Table 1. Descriptive data of post-interruption deletions.

	N	Mean	Std. Deviation	Minimum	Maximum	Occurrences	Approx. %
Deleted	23	.2642	.18677	.00	.67	44	30
Ignored	23	.7361	.18666	.33	1.00	103	70

distributed. The results from the subsequent Wilcoxon test showed that learners do not seem to belong to either a "deleters" or "ignorers" group ($W = 190.0$, $p < .001$).

Location

Research question 1 asked whether the location of an interruption has an effect on whether one deletes text in progress or not. It seems intuitive that the longer one is into composing a chat message, the less likely one will be to react to an interruption by deleting what one has typed up to that point. Indeed, as one's investment in an L2 chat message increases, the "cost" of deleting this same message and starting anew also increases. In order to test out this hypothesis, we isolated all of the lines where a student was interrupted by his/her interlocutor. We then calculated how far into this message the learner was when the interruption appeared. We calculated this in terms of actual keystrokes deep into a composition of any given turn. In order to explore the relationship between the *location* at which an interruption occurred and whether or not the interrupted learner *deletes* what he or she has been typing up to that point, we constructed an over-dispersed binary logistic regression model in the statistical program SAS 9.0 using the "deviance method" to model overdispersion.[3]

Table 2 shows a significant relationship between location and deletion. Specifically, a unit (one keystroke) increase in location tends to decrease the odds of deletion by a multiple of. 958 with a 95% confidence interval (.933, .983). In other words, an interruption is less and less likely to result in the deletion of a message or part of a message "in progress" the further into that message one has typed.

Thus, in answer to the question of whether the location of an interruption has an effect on whether one deletes text in progress or not, we may say that the location or timing at which the interruption occurs seems to have a modest yet significant effect.

Nature of deleted text

Research question 2 asked whether interruptions from one's interlocutor have an effect on the linguistic complexity and lexical richness of deleted text and transmitted text. Though learners did often delete their own messages (or parts thereof) after interruptions appeared, it is clear from the data that they also deleted in a preemptive fashion – that is, where no interruption was present. Such "preemptive" deletions may also be referred to as "self-initiated" deletions – a type of self-initiated self-repair. These are contrasted against "reactive" deletions that occur arguably in reaction to an interruption (other-initiated self-repair). At the very least, we can say that such "reactive" deletions co-occur with interruptions. Thus, deletions occurred in two environments – preemptive and reactive.

The interesting aspect of this phenomenon from an interactionist perspective is what, if any, affect on language production such interruptions might have. Indeed, though synchronous interaction has been touted as being favorable for SLA, it seems reasonable to think that this "favorable" environment may have a downside in that

Table 2. Odds ratio estimate.

Effect	df	Point estimate	*p*	95% Wald Confidence Limits
Location	1	0.958	.0013	0.933–0.983

such interruptions that inevitably occur may be disrupting, and, therefore, may have a negative affect on attention and, by extension, negative consequences for one's linguistic output. In other words, an interruption that arrives while a learner is composing a message containing a developmentally advanced L2 form over which he or she does not have full control may divert the learner from successfully attending to and using the target form.

Preemptive versus reactive deletions

In order to test the possible influence of this variable (preemptive/reactive) on the quality of learner CMC written production, we focused on syntactic complexity, complexity of form, and lexical diversity. Syntactic complexity and lexical richness are considered by several researchers as the building blocks of (oral) proficiency (Bachman, 1990; Doughty, 1991; Warschauer, 1996). The presence of these linguistic features reflects increasing communicative sophistication (Abrams, 2003). According to DeKeyser (2005), grammatical gender (a measure of complexity of form) is among those elements of a second language that are notoriously hard to acquire for native speakers of L1s who do not have them or who use a very different system. These elements of grammar also seem to be strongly resistant to instructional treatments.

The most common ways of measuring syntactic complexity seem to be through the length of production, amount of coordination, and amount of subordination (Ortega, 2003). In the SCMC environment, any measure that is based on sentence-level analysis is problematic given the nature of SCMC interaction. Likewise, an analysis that is based on T-units, which consist of a main clause plus any embedded subordinate clause or phrase, will also run into difficulty in the SCMC environment. For this reason, we decided to adopt the mean number of clauses per C-unit as our measure of syntactic complexity.[4]

To calculate complexity of form we chose to use the measure of *grammatical gender*, which simply reflected the number of occurrences in the chatscript of grammatical gender in German. For our measure of *lexical diversity* we employed the *Index of Guiraud*, which is the number of lexical types divided by the square root of tokens. This measure reduces the influence of the token length or the length of the text under consideration. The higher the score of the Guiraud value *(G)*, the greater the variety of vocabulary included in a text. (See Daller, Van Hout, and Treffers-Daller, 2003 for a detailed discussion of different measures of lexical diversity.) Table 3 and 4 below show the descriptive data for both levels of comparison (deleted text focus and post-deleted text focus).

A Wilcox Signed Ranks test was performed on each of the three quality measures – syntactic complexity (SC), grammatical gender (GEN), and lexical diversity (*G*) – with the single independent variable of "deletion environment" (two levels, preemptive and reactive).

The nature of preemptive versus reactive deletions

Table 5 below shows that for the quality measure 'syntactic complexity' there were no significant differences between preemptive and reactive deletions. In contrast, for both grammatical gender and lexical diversity, the text, in preemptive deletions, was more sophisticated than that in reactive deletions. That is to say, preemptive

Table 3. Descriptive data – deleted text focus (n = 23).

Quality measure	Preemptive/ reactive	Text type	Median	Mean	*SD*	Min.	Max.
Syntactic complexity	P	PDT	.60	.62	.320	0	1.50
		DT	.10	.17	.266	0	1.00
	R	PDT	.16	.38	.427	0	1.00
		DT	0	.21	.331	0	1.00
Grammatical gender	P	PDT	7.0	8.56	5.99	0	21.00
		DT	3.0	3.39	2.23	0	10.00
	R	PDT	0	1.08	1.64	0	5.00
		DT	0	1.00	1.44	0	4.00
Lexical diversity	P	PDT	4.87	4.76	.933	2.83	6.36
		DT	3.0	2.96	.762	1.0	4.35
	R	PDT	1.73	1.86	1.70	0	4.80
		DT	2.04	1.78	1.27	0	3.65

Table 4. Descriptive data – post-deleted text focus (n = 23).

Quality measure	Preemptive/ Reactive	Text type	Median	Mean	*SD*	Min.	Max.
Syntactic complexity	P	PDT	.60	.61	.30	0	1.50
		DT	0	.20	.30	0	1.00
	R	PDT	.25	.41	.43	0	1.00
		DT	0	.12	.21	0	.50
Grammatical gender	P	PDT	9.0	10.26	7.16	0	27.00
		DT	1.0	1.52	1.50	0	4.00
	R	PDT	0	1.39	1.87	0	5.00
		DT	0	.73	1.09	0	4.00
Lexical diversity	P	PDT	4.63	4.71	.86	3.0	6.39
		DT	2.41	2.39	.70	1.0	3.50
	R	PDT	2.45	2.04	1.80	0	4.83
		DT	1.79	1.65	1.29	0	4.28

deletions contained relatively more instances of grammatical gender and a higher degree of lexical diversity than reactive deletions.

The nature of post-deleted text resulting from preemptive or reactive deletions

Table 6 below shows that for the quality measure 'syntactic complexity', there were no significant differences between preemptive and reactive PDT. For the measures grammatical gender and lexical diversity, however, the quality of text in preemptive PDT was significantly more sophisticated than that in reactive PDT. Similar to the findings from the deleted text focus data above, the preemptive deletions contained relatively more instances of grammatical gender and a higher degree of lexical diversity than reactive deletions.

VI. Discussion

Setting aside for the moment the non-significant findings for syntactic complexity, the data suggest that those deletions that occur in a self-initiated or "preemptive"

Table 5. Wilcoxon Signed Ranks Tests – preemptive vs. reactive comparisons (n = 23).

Quality measure	Text type	Neg/pos/ties	N	Mean rank	Sum of ranks	*z*	*p*
Syntactic complexity	PDT	Neg.	8	8.94	71.50	−1.786	.075
		Pos.	14	12.96	181.50		
		Ties	1				
	DT	Neg.	8	9.81	78.50	−.543	.605
		Pos.	8	7.19	57.50		
		Ties	7				
Grammatical Gender	PDT	Neg.	2	2.25	4.50	−3.966	<.001*
		Pos.	20	12.42	248.50		
		Ties	1				
	DT	Neg.	1	8.00	8.00	−3.638	<.001*
		Pos.	19	10.63	202.00		
		Ties	3				
Lexical Diversity	PDT	Neg.	1	5.00	5.00	−4.045	<.001*
		Pos.	22	12.32	271.00		
		Ties	0				
	DT	Neg.	4	6.25	25.00	−3.295	<.001*
		Pos.	18	12.67	228.00		
		Ties	1				

Table 6. Wilcoxon Signed Ranks Tests – Comparison of preemptive vs. reactive deletions (n = 23).

Quality measure	Text type	Neg/pos/ties	N	Mean rank	Sum of ranks	*z*	*p*
Syntactic complexity	PDT	Neg.	9	8.83	79.50	−1.527	.131
		Pos.	13	13.35	173.50		
		Ties	1				
	DT	Neg.	4	5.75	23.00	−.894	.399
		Pos.	7	6.14	43.00		
		Ties	12				
Grammatical gender	PDT	Neg.	2	2.00	4.00	−3.979	<.001*
		Pos.	20	12.45	249.00		
		Ties	1				
	DT	Neg.	3	5.50	16.50	−2.359	.022*
		Pos.	11	8.05	88.50		
		Ties	9				
Lexical diversity	PDT	Neg.	3	3.33	10.00	−3.893	<.001*
		Pos.	20	13.30	266.00		
		Ties	0				
	DT	Neg.	8	8.25	66.00	−1.964	.050*
		Pos.	14	13.36	187.00		
		Ties	1				

environment involve text that is in some ways linguistically more sophisticated than those involving ''reactive'' deletions. Likewise, the text that one types immediately following a self-initiated deletion is more sophisticated than that text that is typed immediately following an ''other-initiated'' or reactive deletion.

In summary, we may say that in two out of the three measures used, learners tended to delete more sophisticated language *before sending it* when this deletion decision is self-initiated rather than other initiated. The trade-off seems to be that they subsequently write more sophisticated text after these self-initiated deletions.

Why do learners delete and subsequently compose more sophisticated text in the preemptive environment over the reactive environment?

When engaging in self-initiated self-repair, learners tend to construct more sophisticated output because they are not bound by an expectation to "react" to any immediately preceding message from their interlocutor. This freedom may result in their taking more chances with the target language as well as their being able to attend to discrete elements in the TL such as morphology and lexicon. Either of these possibilities could account for the higher scores in grammatical gender and lexical diversity.

In the preemptive context, learners also tend to delete more complex language (before sending it) than in a reactive or other-initiated self-repair context. Again, being freed from any pressure to react to an incoming message may allow for a more thoughtful analysis of the text just typed. In this context, it is easy to imagine how one may be more willing to delete a more substantial piece of text in order to produce an equally substantial piece of text in its place.

Why do we not see the same pattern for syntactic complexity that we do for the grammatical gender and lexical diversity conditions?

At least three possible explanations come to mind when trying to account for just why we see no difference for either focus (deleted text or post-deleted text) in the syntactic complexity across the two types of text examined, preemptive and reactive. Essentially these explanations come down to issues of proficiency, attention, and task-related factors. We are quick to point out that it seems difficult – if not impossible – to disentangle these three factors from one another in this type of classroom-based research. For the moment, however, let us address each in turn.

Before launching into this explanation the simple answer may lie in the possibility that our operationalization of the construct of syntactic complexity was too limited, inappropriate, or not sensitive enough to pick up on differences that do exist. Indeed, the proficiency level of the learners (high beginner) as well as certain characteristics of the task (i.e. the use of letters to indicate the final sequence of pictures) may have also mitigated the degree of syntactic complexity that could be generated. Assuming this is not the case for the moment, the non-significant results for this measure may be due to the very small sample size of the present study. When we consider the solid findings of the other two measures (grammatical gender and lexical diversity), however, this seems less likely.

Proficiency

In a relevant meta-analysis study of L2 writing, Ortega (2003) suggests that an observation period of about one year is needed for substantial changes in the syntactic complexity of L2 writing to be evident. That is, across several recent studies, there is little evidence of change in two to three months (one semester).

Ortega's study examined various studies that employed one or more of six measures of syntactic complexity:

(1) Length of production at either the clausal or phrasal level
  (a) Mean length of sentence (MLS)
  (b) Mean length of T-unit (MLTU)
  (c) Mean length of clause (MLC)
(2) Amount of coordination
  (a) Mean number of T-units per sentence (TU/S)
(3) Amount of subordination
  (a) Mean number of clauses per T-unit (C/TU)
  (b) Mean number of dependent clauses per clause (DC/C)

Ortega found that in the studies evaluated, evidence of substantial change in syntactic complexity came after a minimum of nine months of instruction for foreign language students. For the six complexity measures used, the mean for the ESL groups combined was always higher than the mean of the FL groups combined. These differences were only "trustworthy" for the MLS and MLTU measures (based on confidence intervals). Further, the magnitude of change in the shorter term (two to three months) for foreign language students in general was less than that of ESL students (as measured by Cohen's *d* effect size for each study). Thus, there is some evidence that L2 competence may proceed more slowly and might develop less fully in a FL than in a SL instructional setting (Ortega, 2003; Weigel, 2002). The learners in the present study were studying German as a foreign language and were in their second semester of study in the target language.

DeKeyser (2005) suggests that syntactic form-meaning mappings can be "opaque". He reports that even among intermediate-level second language learners there seems to be a virtual absence of verb-subject order in declarative sentences. Hertel (2003), for example, reports that learners of L2 Spanish do not use much verb-subject order until they are quite advanced in their L2 proficiency. Warschauer (1996) argues that more advanced writers or speakers of a language generally use proportionally more subordination than do beginners. He points out that syntactic complexity is related to oral sophistication: as learners' language skills become more sophisticated, so their use of subordination increases.

Wolf-Quintero, Inagaki and Kim (1998) concluded that proficiency is probably related to increases in syntactic complexity in L2 writing when proficiency level is defined by programmatic level rather than by a holistic rating. They suggest a non-linear complexification as far as subordination is concerned (Wolf-Quintero Inagaki & Kim, 1998) and argue that advanced proficiency groups should be expected to produce writing that capitalizes on complexification at the phrasal rather than the clausal level.

Shang (2007) explored the overall effect of using electronic mail on the improvement of syntactic complexity, grammatical accuracy, and lexical density, with special attention paid to the possible influence that the number of email exchanges might have on performance. Participants were broadly categorized as "intermediate". Shang found that with regard to syntactic complexity, only the sentence complexity measure indicated a significant difference and that this was only for one of the three "number of exchange" conditions examined. Interestingly,

Shang found that as participants increased syntactic complexity, they tended to decrease grammatical accuracy and lexical density, and vice versa. This last finding leads us into another possible type of explanation for the non-significant results for syntactic complexity in the present study – attention.

Attention

The role of attention and noticing is a widely debated and current topic in SLA research. Relevant to the present discussion on syntactic complexity, it seems that certain aspects of language such as learning lexicon and morphology may require attention and awareness in ways that learning syntax does not (VanPatten, 1994; Schwartz, 1993). This may be related to the notion of processing space, in that these lower-level learners simply do not have enough processing space to compose syntactically more complex language in the PDT environment. The added time pressure introduced by both the nature of SCMC interaction and the task/context itself may be a contributing factor to the (low) amount of attention allocated to syntactic complexity. This may help explain Shang's findings above for asynchronous interaction, which suggests that more opportunities in correcting each other's email messages may lead students to venture into using more complicated grammatical structures.

Task-related factors and context

The interaction approach ascribes high importance to the nature of the task for eliciting positive types of learner interaction. In addition to various general discussions of the role of task type in learner interaction in face-to-face (Pica et al., 1993) as well as CMC interaction (Smith, 2004), there is evidence that a number of task-related factors affect the syntactic complexity levels of L2 writing (Weigel, 2002).

In a study that set out to examine the writing capabilities of secondary level, novice French as a foreign language learners, Way, Joiner, and Seaman (2000) sought to determine how these learners would respond to descriptive, narrative, and expository tasks across three different prompts, and also to determine the effects of these variables on overall writing quality, fluency, syntactic complexity, and accuracy. They operationalized syntactic complexity in terms of mean length of T-unit. The type of task prompt was found to have a significant effect on the writing samples of novice learners. What they referred to as the bare prompt usually produced writing with the poorest overall quality (holistic scores), the least fluency (length of product), the least syntactic complexity (MLTU), as well as the lowest accuracy (percentage of correct T-units).

Other context factors

Abrams (2003) suggests that language learners' use of certain syntactic features may merely reflect the different perception of asynchronous CMC as requiring a relatively high register (such as formal writing) with more complex sentence structures. It follows then that SCMC might not explicitly require such attention to this higher register or form since it is viewed as something in between writing and speaking.

VII. Limitations

"Interruptions" in SCMC

Throughout this paper, we have been referring to the appearance of an interlocutor's message during one's own message construction phase as an *interruption*. Strictly speaking, however, these are not interruptions at all – at least not from a conversational analysis perspective. A structural-syntactic description of interruptions can be found in Schegloff (1973), who suggests that interruptions are cases when a speaker projects his or her talk to begin in the middle of a point that is in no way a possible completion point for the turn. In most (written) SCMC environments, of course, one is blind to such completion points. This is not to say that such chat interfaces do not exist, only that they are not commonly used for L2 pedagogical purposes. It is less uncommon to see interfaces that show *when* one's interlocutor is typing some text, but not *what* they are typing.

Overlapping messages are a fundamental part of SCMC interaction. However, it is equally difficult to speak of *overlaps* in an SCMC context largely for the same reasons discussed above in reference to interruptions. Schegloff (1973) describes overlaps as talk that begins at a possible completion point of the interlocutor's talk. When referring to the typical SCMC written environment, we suggest the term "incursion" to refer to typed text that appears on the screen of one's interlocutor before s/he has sent a message in progress. The effects of such incursions have been demonstrated above to a certain degree. Further analysis of the nature, effect, and perception of incursions could be carried out in future in a "tri-pane" environment where both participants could see their interlocutor's message in progress as well as the chatscript of sent messages. In this latter case, we may indeed be able to go back to the terms "interruptions" and "overlaps", since each participant would have full access to the other's message in progress. An exploration of the efficacy of such an environment and its potential for SLA/CALL research has yet to be fully explored. For example, whether such interruptions in such a tri-pane environment are viewed by participants as disruptive or as contributing cooperatively (Bennett, 1981) is an empirical question not yet explored in this environment.[5]

VIII. Conclusion and future directions

This study is a continuation of efforts to provide richer data in the analysis of SCMC interaction in foreign and second language learning. Through the methodological approach outlined in this paper, we gain clearer insights into the nature of SCMC interaction, coming somewhat closer to a "first person perspective" (O'Rourke, 2008). Recent research in this area (Lai & Zhao, 2006; O'Rourke, 2008; Sauro & Smith, 2008; Smith, 2008; Smith & Gorsuch, 2004) has made a compelling case that it is now time to move beyond this methodological discussion and integrate some form of these additional data sources as a matter of course in CMC/SLA research.

Results from the present study have demonstrated that incursions by the interlocutor during the message construction phase seem less and less likely to lead to a deletion the further into a "message in progress" this incursion appears. Further, in connection with self-repair, there is some evidence that learners create more linguistically complex output when this self-repair is self- rather than other-initiated.

These findings suggest several possible directions for future research that would further our understanding of the function and effect of incursions on L2 learner

production during chat. While this study focused on the linguistic complexity and lexical richness of learner output under different incursion conditions, it did not examine the relative accuracy of learner output. If, as has been suggested, incursions during chat draw learners' attention away from attending to their output, would this shift in attention be reflected in a drop in accuracy, particularly as concerns target-like use of developmentally more advanced forms? A related direction concerns the relationship between the function (e.g. topic shift, question, response to a question, etc.) of the incursion and the likelihood that the interrupted turn would be deleted. And finally, future research may explore the broader interaction of task type and the amount, frequency, and nature of incursions during task-based interaction via chat.

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Notes

1. Heritage speakers have been defined by Valdés (2000) cited in Blake & Zyzik (2003) as "a student who is raised in a home where a non-English language is spoken, who speaks or merely understands the heritage language, and who is to some degree bilingual in English and the heritage language."
2. American Council on the Teaching of Foreign Languages, Alexandria, Virginia USA.
3. Over-dispersion occurs when the observed variance of the data is larger than the predicted variance. In this case, though there were 23 participants, each participant did not witness the same number of interruptions. Thus, the 147 interruptions were not evenly distributed across each participant. The "deviance method" in SAS works to lower this over dispersion effect.
4. C-units have been defined as an independent utterance that provides referential or pragmatic meaning (Foster & Skehan, 1996).
5. Indeed, the interface used will certainly affect the nature of the interaction in some way. As one reviewer points out we must be careful to take into consideration the technology itself and acknowledge its potential impact on user interaction, behavior, and, therefore findings.

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Appendix 1

Coding symbol	Meaning	Explanation
~~strikethrough~~	Indicates text that has been typed and subsequently deleted before message is sent.	Strikethrough shows messages or parts of messages that a learner has typed but deleted before sending the final message. None of the strikethrough text appears on the screen of the interlocutor nor on the hard copy of the chat log.
Black bar + underline▮	Indicates text with embedded deletion has been deleted. Black vertical bar indicates where deletion begins. Deleted text is underlined to the left of the bar.	Black bar + underline is used when a message or part of a message which already has some deleted sections is subsequently deleted in its entirety. This coding allows the acknowledgment of deletions of text with embedded deletions.
[post-hoc inserted text]	Indicates that the text within the brackets has been inserted at a later point in the message.	Note: A second, third, etc. occurrence of post-hoc inserted text is signified with double/ triple brackets respectively [[text]], [[[text]]].
[~~post-hoc deleted text~~]	Indicates that the deleted text within the brackets was deleted at a later point in the message.	Note: A second, third, etc. occurrence of post-hoc deleted text is signified with double/ triple brackets respectively [[text]], [[[text]]].
[+]	Indicates the point in the message at which the [post-hoc inserted text] was inserted.	Note: The point in the message at which a second, third, etc. post-hoc insertion is made is signified with double/triple brackets respectively [[+]], [[[+]]].
[−]	Indicates the point in the message at which the [post-hoc deleted text] was deleted.	Note: The point in the message at which a second, third, etc. post-hoc deletion is made is signified with double/ triple brackets respectively [[−]], [[[−]]].
[+/−]	Indicates the point in the message at which a correction was made.	This code is used for short one or two character corrections such as for capitalization, spelling, typos, etc. This code eliminates the need for using the lengthier coding of [−][+] in sequence.
[line number] Example: [3]	Indicates the precise point in the text currently being typed (but not yet sent) when a new line from the interlocutor appears on the screen of the target participant.	Often a line from the interlocutor will appear on the screen mid-way through a message, which is in the process of being typed. This code indicates both the point at which this new message appears and its line number on the chat log/chatscript.

Adapted from Smith (2008).