The Mediation of EFL Learners' Interaction for Word Processing within Collaborative Output

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Abstract

Collaborative output has been found to facilitate L2 lexical learning due to the cognitive word processing engendered in it. Yet it is not clear how interactions involved in collaborative output could affect learners' word processing and hence their lexical learning. This paper takes a sociocultural perspective to investigate Chinese EFL learners' interactional processes in performing collaborative output tasks and how these interactions were associated with their cognitive word processing. A microgenetic analysis revealed that the participants engaged in six categories of interactional process and participants' interactional processes mediated their word processing. The findings highlight the lexical learning mechanism afforded by collaborative output.

Keywords: collaborative output, interactional process, cognitive word processing, mediation

Introduction

Since interaction and output have been postulated to play important roles in second language acquisition (SLA) (Long, 1996; Swain, 1995), quite a few studies (e.g., Borer, 2007; Bruton, 2007; de la Fuente, 2002, 2003; Ellis & He, 1999; Fernandez Dobao, 2014; Kim, 2008; Lee, 2009; Mendoza, 2004; Nassaji & Tian, 2014; Newton, 1995; Niu, 2014; Niu & Helms-Park, 2014; Qi, 2001; Sahin, 2007; Smith, 2004, 2005; Tocalli-Beller, 2005) have examined lexical learning within collaborative output. These studies primarily focused on the lexical learning effect, learners' word meaning negotiation mechanism, learners' cognitive word processing (i.e., using or talking about a word), and learners' cognitive, interactional as well as scaffolding strategies for working out word meanings. These studies not only help us understand the lexical learning effect of collaborative output and reveal the lexical learning process involved but also demonstrate that lexical learning is both a cognitive and a social process. Yet, none of these lexis-focused studies have examined how the social process and the cognitive process are associated in bringing about lexical learning within collaborative output, although there are studies which associated learners' creativity and lexical-grammatical features of their language use (McDonough, Crawford, & Mackey, 2015) or related student talk with text quality (McDonough, Crawford, & De Vleeschauwer, 2016) in completing collaborative output tasks. To bridge this gap, the present paper reports on a study which, from a sociocultural perspective, investigated Chinese EFL (English as a foreign language) learners' interactional processes and how their interactions mediated their cognitive word processing within collaborative output.

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A Sociocultural Perspective on Collaborative Output

Sociocultural theory (SCT) maintains that human cognitive development, including language development, is mediated by social interactions (Lantolf, 2000, 2011; Lantolf & Thorne, 2006). Social interactions refer to interpersonal interactions as well as interactions between human beings and the social world. Thus, mediation captures human beings' relationship with the physical world as well as their mental world in that just as human beings use physical tools to mediate labor and manipulate nature, they use psychological tools, such as language, gestures, mnemonic techniques, mathematical symbols, and diagrams, to mediate higher mental processes (Vygotsky, 1978). Language is the primary mediating tool for cognitive development (Appel & Lantolf, 1994; Swain, Lapkin, Knouzi, Suzuki, & Brooks, 2009).

According to the sociocultural orientation, language development is realized within learners' zone of proximal development (ZPD). ZPD refers to "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). ZPD is a psychological site where learning or internalization takes place. The adults or more capable peers play a mediating role in the learning process (Lantolf, 2000; Ohta, 2001). Collaborative output tasks, as deployed in this study, incorporate social interactions and language production, and hence should be able to engender learners' mediating behaviors, embodied as their interactional processes, which will be scrutinized in order to reveal how learners' interactions provide lexical learning affordances for their partners and themselves.

By drawing on SCT, human cognitive development including language development can be observed through an examination of language use. Vygotsky (1978) argued that children's cognitive development is a process of internalizing interpersonal processes and transforming them into intrapersonal ones. Thus, internalization constitutes an essential aspect of human cognitive development, which has been conceived as "the internal reconstruction of an external operation" (Vygotsky, 1978, p. 56). The reconstruction process involves the transformation of interpersonal activity into intrapersonal activity and the creation of a new psychological plane. The transformation implies a series of developmental changes in the function and structure of social forms of behavior. Specifically, according to Vygotsky (1978), children's language initially serves communicative functions and gradually develops to fulfill the function of cognitive self-regulation as it transforms from social speech, to egocentric speech, to inner speech. Therefore, human cognitive development as well as language development is observable, and in order to understand language development, a genetic method (Ellis & Barkhuizen, 2005; Wertsch, 1985) should be employed; that is, learners' mental abilities should be studied as they are in the process of coming under the mediated control of the learners themselves, particularly in the process of performing collaborative output tasks as in this study.

Interaction and Cognitive Word Processing within Collaborative Output

Existing studies examining interaction and L2 lexical learning within collaborative output have obtained positive results. Specifically, studies found the superior lexical learning effect of interactionally modified output to premodified input or interactionally modified input (de la Fuente, 2002; Ellis & He, 1999; Smith, 2004). Studies have also shown that collaborative output was more effective than individual output for lexical learning (Kim, 2008; Nassaji & Tian, 2014), and quartet groups produced more lexical language-related episodes and solved more lexical problems than dyadic groups in collaborative writing (Fernandez Dobao, 2014). Additionally, researchers observed lexical learning from various collaborative output tasks such as communicative tasks (Newton, 1995), EFL learners' situation-and-question-prompted collaborative dialogues with English native speakers (Qi, 2001), face-to-face and computer-mediated interactions (de la Fuente, 2003), and teacher-student collaborative oral translation (Bruton, 2007). Although some of the existing studies (e.g., de la Fuente, 2002, 2003; Newton, 1995; Qi, 2001) did attribute the lexical learning effect to interaction and the quality of word processing in collaborative output, interaction and word processing were not their primary concern.

Other than the above-mentioned studies, the studies that have concerned themselves with the cognitive word processing engendered in collaborative output are Borer (2007) and Niu and Helms-Park (2014). Borer

(2007), examining L2 English learners' solitary and collaborative lexical processing behaviors in performing word-focused activities, identified three types of word processing: repetition, manipulation, and generation, and observed no correlation between the frequency of the learners' word processing and their word retention a week later and a month later. In light of Borer (2007), Niu and Helms-Park (2014), in examining the impact of both written and oral collaborative text-reconstruction on Chinese EFL learners' lexical learning, recognized four types of word processing: word simple repetition (i.e., learners verbalizing target words or target-word-embedded sentences), word meta-talk (i.e., learners explicitly or implicitly talking about word knowledge), word generative use (i.e., learners' use of target words in reconstructed sentences), and word reflective repetition (i.e., learners verbalizing target words during sentence reconstruction), and found statistically significant correlations between learners' lexical learning and their word processing frequency. Apparently, analyzing learners' word processing helps understand the source of lexical learning within collaborative output. What interactions can be engendered in learners' collaborative output and how interactions are connected with word processing are also issues worth exploring since the uniqueness of collaborative output for superior lexical learning should lie in the interactions involved.

Speaking of interactions, several studies, especially those taking the sociocultural orientation (e.g., Mendoza, 2004; Sahin, 2007; Tocalli-Beller, 2005), have looked into the scaffolding strategies that learners might resort to in performing assigned collaborative word-focused output tasks. Mendoza (2004), through conversational analysis of seven L2 English learners' collaborative knowledge construction of unknown academic words upon reading a text, identified both non-linguistic assistance strategies (e.g., using a dictionary or textbook) and linguistic assistance strategies (e.g., providing theoretical or functional definition). Tocalli-Beller (2005) examined L2 learners' lexical learning from collectively comprehending language plays, puns, riddles, humor, and cartoons, finding that learners adopted such cognitive strategies as repetition and paraphrasing as well as interactional strategies like information request, meaning negotiation, and teacher support. Sahin (2007), from computer-mediated communicative task performances between French and Russian learners and French and Russian native-speaking prospective teachers, identified 14 instances of scaffolding: simplifying the language, asking for completion, and breaking the task into smaller, more manageable parts, to name a few. In these comprehension-targeted studies, the identified cognitive, interactional and scaffolding behaviors involve interactional processes and word processing, which, however, were not identified. Hence these studies could not reveal how interactions might be associated with learners' word processing.

To recap, the above review reveals that existing studies on collaborative output and lexical learning did not fully recognize interactional processes or distinguish interactional processes from cognitive word processing in learners' collaborative output. This paper thus aims to examine how learners' interactional processes are connected with their word processing.

Research Questions

To address an under-studied area, the present study addresses two research questions:
1. What interactional processes are involved in L2 learners' collaborative output?
2. How do L2 learners' interactional processes associate with their cognitive word processing within collaborative output?

Method

Participants

Sixteen first-year English majors, including 12 females and 4 males, from a university in China participated in the study. The participants, aged from 18 to 20, had learned English for 7 to 11 years, came from four classes, and were all upper-intermediate English learners and active participants in their classes, which ensured their optimal representativeness and successful completion of the tasks. They were divided into 8 pairs according to

their gender (i.e., male/male and female/female), English core course semester-final scores, and enrollment in the same class in order to facilitate cooperation in each pair.

Instruments
The research instruments were two collaborative text-reconstruction tasks, the same as those employed in Niu and Helms-Park (2014).[1] They were reading-based, lexis-focused, and word-cued so that learners could use target words in task performance. The target words were keywords of the text and unknown to the participants based on a pilot done with the participants' peers and the participants' post-task report. Both tasks, one being collaborative written reconstruction and the other collaborative oral reconstruction (shortened as Written Output and Oral Output, respectively), were dyadic, requiring participants to read one passage individually first, then to reconstruct the content of the passage in pairs by using the cued words, including target words, and finally to compare their reconstruction with the original passage.

The input passage, the same as the one employed in Niu and Helms-Park (2014), was entitled *The Land of Disney* and adapted from *BBC English*. The passage was chosen because all participants should be familiar with the topic, the article itself was not difficult but contained some relatively difficult words; the passage was expository so that participants could memorize and recall its content easily in order to complete the text-reconstruction tasks. The passage was adapted by cutting down culture-loaded parts and removing non-essential sentence embeddings, which ensured participants' adequate comprehension when reading the passage. The adapted passage had 486 word tokens and 267 word types with a type-token ratio of 54.94%. Sixteen words were selected as cues, among which 10 were target words, so the known word coverage was approximately 97.94% of the word tokens, close to the ratio for pleasure reading (Hirsh & Nation, 1992).

Data Collection Procedure
The data were collected by meeting the participants 4 times within two weeks:
1. At Meeting 1, participants were informed about the study, signed the consent letter, and were divided into 8 pairs with each pair doing either Written Output or Oral Output.
2. At Meeting 2, participants filled out the background information survey and attended the practice session in order to get familiar with the task format. The practice session was identical to the treatment except that a shorter article was used and less time was allowed.
3. At Meeting 3, each dyad performed the assigned task as instructed while the researcher observed and took notes. Participants primarily used English and only occasionally resorted to Chinese during task performance. Performances were videotaped with participants' permission. Time on task for the eight pairs ranged from 24 to 44 minutes.
4. At Meaning 4, each dyad conducted a stimulated recall on their task performance while watching the taped video and being prompted by the question, "What are you thinking about here?" from time to time. The stimulated recall, aiming for more valid data analysis, lasted for about one hour for each pair and was videotaped.

Data Analysis Procedure
Data analysis mainly focused on the dyadic conversations resulting from the reconstruction and comparison stages of both tasks, with Oral Output performers' monologic discourse, and Written Output performers' written work as well as the post-task stimulated recall acting as reference for more reliable and valid analysis. A microgenetic approach was followed in data analysis. This approach, involving utterance-by-utterance analysis of interactions (Ellis & Barkhuizen, 2005) has often been adopted by studies within the sociocultural paradigm (e.g., Swain & Lapkin, 1998) to examine the formation and moment-by-moment unfolding of the process of human mental development, for example, the internalization of word meaning in a specific context, so as to reveal causal dynamic relations underlying psychological behaviors (Vygotsky, 1978). The microgenetic analysis is usually conducted in three steps: "selecting relevant episodes for analysis; determining patterns of interaction; and determining microgenetic growth" (Ellis & Barkhuizen, 2005, p. 236). In this study, the relevant episodes are

the target-word-related episodes (TWREs) as the study is focused on lexical learning, and data analysis should be centered on target words; the patterns of interaction are the interactional processes involved in the TWREs; and the microgenetic growth refers to the participants' processing of the target words in performing collaborative output tasks. Participants' processing of target words has been reported in Niu and Helms-Park (2014)[2] and reviewed earlier in this paper. Data analysis of the present study mainly focuses on identifying those interactional processes. In response to the research questions, the data were analyzed using the following procedure:

First, TWREs were identified and coded by following an interactional analysis (Ellis & Barkhuizen, 2005). By drawing on the definitions of language-related episode (LRE) (Swain, 1998) and vocabulary-related episodes (VRE) (Borer, 2005), *TWRE was defined as an excerpt of a dialogue or a monologue in which participants focused on a target word by verbalizing, repeating, questioning or correcting its form, meaning or use, or simply using it in a sentence.* A TWRE started when participants began talking about a target word and ended when they changed the topic. Each TWRE was encoded as: participants' identity – task – task stage – TWRE number – target word. For example, the TWRE in (1) is coded as Ding & Zhong – Written Output – reconstruction – TWRE 1 – *perilous*, which means the first TWRE from Ding & Zhong's (all student names are pseudonyms in this paper) Written Output performance at the reconstruction stage and relating to the target word *perilous*. A TWRE usually covers one or more conversation turns as illustrated by the episode in (1), which runs over eight turns.

(1) Ding & Zhong – Written Output – reconstruction – TWRE 1: perilous
    1. Ding: First, *perilous*
    2. Zhong: The first … let's begin.
    3. Ding: Ok.
    4. Zhong: It is peri, it is *perilous* to …
    5. Ding: *perilous*
    6. Zhong: predict the future, *perilous* to, it is *perilous* to predict the future.
    7. Ding: It's *perilous*
    8. Zhong: *perilous* to predict the future.

Then, interactional processes were identified and coded within TWREs. First the existing categories (co-composing, other-correction, self-correction, and encouragement) reported in Foster and Ohta (2005) were applied to code the data of two pairs and were modified. Then the modified categories were applied to code the data of the other six pairs. Thus, a tentative coding scheme was developed. Inter-rater coding and triangulation with participants were also pursued so as to increase coding validity and reliability. The inter-rater coding reliability was 87.4%. Then the revised coding scheme was applied to code all the data twice. The intra-rater reliability was 94.2%. Disputed cases were all resolved.

Afterwards, participants' interactional processes were quantified in order to reveal participants' engagement with each interactional process. Then participants' interactional processes were associated with the corresponding cognitive word processing involved: word simple repetition (WSRp), word metatalk (WMt), word generative use (WGU), and word reflective repetition (WRRp), as reported in Niu and Helms-Park (2014). Through associating participants' interactional processes and word processing, four categories of relationship were revealed, which are reported below.

Results

As presented in Table 1, data analysis revealed that the eight pairs produced 150 TWREs altogether, of which 83 were generated by the four Oral pairs and 67 produced by the four Written pairs.[3] Within the 150 TWREs, six types of interactional process were identified, namely co-composing of utterance, request for assistance, provision of help, other-correction, uptake, and self-correction. In terms of frequency, the six types appeared 396 times within the 150 TWREs. Of the six types, co-composing of utterance took up the largest share (46.5%) followed by other-correction (13.9%), request for assistance (13.6%), and provision of help (11.1%) while self-

correction occurred the least (6.6%). The four Oral Output pairs and the four Written Output pairs engaged in close numbers of interactional process, 199 and 197 instances respectively. However, the eight pairs revealed great variation in terms of the number of interactional process, ranging from 21 to73.

Table 1
*Number of TWRE and Types of Interactional Process in Output T*asks

Task type	Participants	No. of TWRE	Types of interactional process						Total
			1#	2#	3#	4#	5#	6#	
Oral output	Wen & Ma	19	15	1	1	8	5	3	33
	Zhang & Ke	23	23	7	5	4	4	4	47
	Ma & Zhu	21	36	8	8	13	4	2	71
	Chen & Hu	20	25	6	6	4	5	2	48
	Total	*83*	*99*	*22*	*20*	*29*	*18*	*11*	*199*
Written output	Ding & Zhong	19	36	7	6	12	7	5	73
	Yu & Lin	14	23	11	10	8	6	4	62
	Bi & Lu	21	13	11	6	5	1	5	41
	Dong & Xiao	13	13	3	2	1	1	1	21
	Total	*67*	*85*	*32*	*24*	*26*	*15*	*15*	*197*
Sum		150	184 (46.5%)	54 (13.6%)	44 (11.1%)	55 (13.9%)	33 (8.3%)	26 (6.6%)	396 (100%)

Note. 1#, 2#, 3#, 4#, 5# and 6# refer to co-composing of utterance, request for assistance, provision of help, other-correction, uptake, and self-correction respectively.

Participants' interactional processes were found to entail or contribute to their word processing in performing collaborative output tasks; and each type of interactional process contributed to all four categories of word processing: word simple repetition (WSRp), word meta-talk (WMt), word generative use (WGU), and word reflective repetition (WRRp). Participants' interactional processes and corresponding mediating relations in word processing are presented in four sections because request for assistance and provision of help are closely connected and allocated into one category, as are other-correction and uptake.

Co-composing of Utterance and Mediation for Word Processing
Co-composing of utterance occurred while participants were composing the target idea and sentence together with their partners. It manifested as participants repeating, continuing, or modifying their partners' utterance or simultaneously producing an utterance, as illustrated in Excerpts (2)-(5) respectively. Meanwhile, these co-composing interactions incorporated participants' four categories of word processing (i.e., WSRp, WMt, WGU, and WRRp). Specifically, in Excerpt (2), first Zhong was writing and uttering the relevant sentence (Turn 1) ("turn" will be shortened as "T" hereafter), but before Zhong could finish, Ding repeated the target word *perilous* (T2), and then Zhong continued to complete the sentence (T3). This co-composing process engendered Ding's reflective repetition of *perilous* at the word processing level. In Excerpt (3), Zhong in Turn 2 took up Ding's utterance and completed it until Turn 4 while Ding was considering the grammar of the sentence (T3). This co-composing process engendered Zhong's generative use, metatalk (provide spelling twice), and reflective repetition of *acuity* as Zhong was anxiously helping Ding to put the sentence on paper. In Excerpt (4), Wen modified Ma's utterance (T2), which Ma accepted as revealed from her continuation of Wen's modification (T3). Wen's modification involved generative use of *encapsulate*. In Excerpt (5), Yan and Zhu said the word *encapsulate* together (T3) right before reconstructing the relevant sentence. This co-composing action involved their simple repetition of *encapsulate*.

(2) Ding & Zhong – Written Output – reconstruction – TWRE1: *perilous*[4]
    1. Zhong: It is peri, it is perilous to …
    2. Ding: *perilous* (WRRp) [co-composing of utterance]
    3. Zhong: predict the future

(3) Ding & Zhong – Written Output – reconstruction – TWRE 7: *acuity*
    1. Ding: He has
    2. Zhong: *acuity* (WGU)   [co-composing of utterance]
    3. Ding: he had because he died
    4. Zhong: yes, *a-c-u-i-t-y* (WMt), *acuity* (WRRp), *a-c-u-i-t-y* (WMt), and management ability [co-composing of utterance]

(4) Wen & Ma – Oral Output – reconstruction – TWRE3: *encapsulate*
    1. Ma: But it does not encapsulate the America.
    2. Wen: no other things in America today can *encapsulate* (WGU) America
         [co-composing of utterance]
    3. Ma: America today like Disney.

(5) Yan & Zhu – Oral Output – reconstruction – TWRE 12: *encapsulate*
    1. Yan: Yes.
    2. Zhu: encapsulate
    3. Yan & Zhu: *encapsulate* (WSRp) [co-composing of utterance]
    4. Zhu: It is said that Coca and McDonald's
    5. Yan: Coca-cola and McDonald's cannot encapsulate the
    6. Zhu: the whole modern America
    7. Yan: the whole modern America.

Request for Assistance, Provision of Help, and Mediation for Word Processing
Request for assistance arose with a participant explicitly indicating their lack of knowledge or uncertainty about text reconstruction to their partner, whereas provision of help occurred while a participant providing the answer, confirming or clarifying what is questioned, at the partner's indication of lack in knowledge or of uncertainty. In terms of thematic focus, participants requested assistance and correspondingly were provided help with word form, word meaning, word use, and ideas expressed, as illustrated in Excerpts (6)-(9) respectively. These assistance-seeking and assistance-providing interactions led to participants' word processing, including WSRp, WMt, WGU, and WRRp. In Excerpt (6), Ding asked for the word *heed* (T2), which Zhong had used in the phrase *pay heed*, and then Zhong repeated the phrase twice and paraphrased *heed* to help Ding better understand its form (T3). Thus, Ding's enquiry stimulated Zhong's generative use and metatalk of *heed*. In Excerpt (7), Zhang asked about the meaning of *encapsulate* (T1) followed by Ke's provision of Chinese meaning for the word (T2). Zhang's assistance-seeking interaction involved simple repetition of *encapsulate*, and Ke's provision of help engendered metatalk of the word. In Excerpt (8), Ding asked about the use of *acuity* (T1), followed by Zhong's provision of the relevant sentence (T2), hence giving rise to Zhong's generative use of the word. In Excerpt (9), Ke asked for the idea following *instigate* (T1) and Zhang repeated *instigate* and finally provided the idea (T2). Hence, Ke's assistance-seeking interaction stimulated Zhang's reflective repetition and generative use of the word *instigate*.

(6) Ding & Zhong – Written Output – reconstruction – TWRE12: *heed*
    1. Zhong: yes. Because people still pay *heed* on Disney.
    2. Ding: *pay what?* [request for assistance]
    3. Zhong: pay *heed* (WRRp), *attention* (WMt), pay *heed* (WRRp), but it's a *verb* (WMt), not … [provision of help]

(7) Zhang & Ke – Oral Output – reconstruction – TWRE14: *encapsulate*

1. Zhang: encapsulate, what is *encapsulate* (WSRp)*?* [request for assistance]
2. Ke: *gaikuo* (WMt), *gaikuo* (WMt) ((Chinese meaning of encapsulate)), *encapsulate* (WSRp) [provision of help]
3. Zhang: Ok, encapsulate.

(8) Ding & Zhong – Written Output – reconstruction – TWRE7: *acuity*
1. Ding: *How can we use this word?* [request for assistance]
2. Zhong: in business he's *acuity* (WGU) [provision of help]

(9) Zhang & Ke – Oral Output – reconstruction – TWRE6: *instigate*
1. Ke: *instigate* (WRRp) what? I forgot. [request for assistance]
2. Zhang: *Instigate* (WRRp)? Er … let me see. He *instigate* (WRRp) the … Oh, he *instigate* (WGU) the ideas of branding. [provision of help]

Other-correction, Uptake, and Mediation for Word Processing

Other-correction was involved while a participant correcting the partner's error or utterance explicitly or implicitly, whereas uptake meant a participant's acceptance of or corrective feedback to the partner's corrections or different opinions. Participants' other-correction and uptake concerned word form, word meaning, word use, language form other than target words, and ideas expressed, as shown in Excerpts (10)-(14) respectively. These correction and uptake interactions involved or brought about participants' use of all four categories of word processing (i.e., WSRp, WMt, WGU, and WRRp). Specifically, in Excerpt (10), Ma corrected Wen's mispronunciation of the word *epoch* (T3), and Wen accepted Ma's correction as shown by her repetition (i.e., uptake) of the correct pronunciation (T4). Thus, Ma's correction and Wen's uptake involved metatalk and generative use of *epoch*. In Excerpt (11), Chen thought that the meaning of *instigate* is *tui guang* in Chinese (T3), while Hu implicitly indicated that *tui guang* might not be the correct meaning by providing the English meaning of *tui guang* (T4). Then Chen uttered the more exact meaning of *instigate* and even the reconstructed sentence (T5). In this case, Chen engaged in uptake of Hu's implicit correction. This implicit correction and uptake process concerning word meaning engendered metatalk and generative use of *instigate*. In Excerpt (12), hearing Ding's question (T1), Zhong produced the sentence containing *acuity* (T2), but Ding questioned the part of speech of *acuity* as it is used in the sentence produced by Zhong (T3). Then Zhong uptook Ding's questioning and corrected the sentence (T4). In this excerpt, Ding's correction and Zhong's uptake engendered metatalk (clarifying part of speech), generative use, and reflective repetition of *acuity*. In Excerpt (13), Yu corrected the tense of Liu's utterance containing *idyllic* (T2) and Liu accepted Yu's correction as shown by her revised repetition of the sentence (T3). Though tense was not the target form of the study, this excerpt indicates that participants' focus on language forms other than target words could also engender word processing, as in Excerpt (13), Liu's uptake of Yu's correction stimulated generative use of *idyllic*. Excerpt (14) shows Ma's correction of the idea that Wen produced, and Wen accepted the correction through repeating the sentence Ma produced together with Ma (T3). At the word processing level, Ma's correction of idea and Wen's uptake engendered generative use of *espouse*. Besides the above five situations, Excerpt (15) shows a case of other-correction and uptake leading to word metatalk and word simple repetition. First, Wen read through the target words (T1) and then Ma corrected Wen's wrong stress in the word *acuity*, and Wen uptook Ma' correction (T3).

(10) Wen & Ma – Oral Output – reconstruction – TWRE11: *epoch*
1. Ma: the 20th century
2. Wen: as the epoch [epɔk]
3. Ma: *epoch [iːpɔk]*(WMt) [other-correction]
4. Wen: *epoch [iːpɔk]* (WGU) of Disney. [uptake]

(11) Hu & Chen – Oral Output - reconstruction – TWRE5: *instigate*
1. Chen: he instigated the idea of branding, branding
2. Hu: No, instigate…instigate ((Chen looking at the word from wordlist))
4. Chen: Yes, yes, tui guang ((Chinese meaning of *instigate* provided by Chen)), hao xiang ((meaning 'it seems')).

5. Hu: *tui guang* (WMt) ((H repeating Chinese meaning of instigate
       provided by Chen)), *expand* (WMt) [other-correction]
6. Chen: *fa qi* (WMt) ((correct Chinese meaning of instigate, uttered by Chen)), *instigate* (WGU) the idea of branding and
       … [uptake]
7. Hu: What …?
8. Chen: Is that? *Jiu shi ta* *fa qi* *pin pai tui xiao de na ge li nian* ((this is Chinese, meaning 'it is that he instigated the idea
       of branding and merchandising')).

(12) Ding & Zhong – Written Output – reconstruction – TWRE7: *acuity*
1. Ding: How can we use this word?
2. Zhong: In business he's ´acuity.
3. Ding: No, this is a *noun* (WMt). [other-correction]
4. Zhong: It means he has *a´cuity* (WGU)*, a´cuity* (WRRp) and, there are
       two, I think, there are two … [uptake]

(13) Yu & Liu – Written Output – reconstruction – TWRE10: *idyllic*
1. Liu: Yeah. The realistic is not *idyllic*.
2. Yu： … *was not always* … [other-correction]
3. Liu: was not always *idyllic* (WGU). [uptake]

(14) Wen & Ma – Oral Output – reconstruction – TWRE13: *espouse*
1. Wen: Oh, he made cartoons espoused by the ordinary people through …
2. Ma: *espouse* the ordinary people *ba* ((a Chinese exclamatory word))   [other-correction]
3. Wen & Ma: Oh, *espouse* the ordinary people. [uptake]

(15) Wen & Ma – Oral Output – reconstruction – going over cued words
1. Wen: espouse, genius, heed, honor, identify (with), idol, `idyllic, instigate
2. Ma: *ì´dyllic* (WSRp; WMt)   [other-correction]
3. Wen: Oh, *ì´dyllic* (WSRp)   [uptake]

Self-correction and Mediation for Word Processing
Self-correction appeared in participants' self-initiated correction or revision of errors or improper behaviors. Participants self-corrected word form, word use, and ideas expressed, as exemplified in Excerpts (16)-(18). These self-correction actions engendered participants' word processing, including WSRp, WMt, WRRp, and WGU. In Excerpt (16) Ding corrected her own improper stress of the word *acuity* (T1) while she was repeating the word before producing the right sentence. Ding's self-correction engendered simple repetition and metatalk of the word *acuity*. In Excerpt (17), Zhong noticed that *heed* should be used as a verb (T4) while explaining the phrase *pay heed* to Ding. Then Zhong reproduced a sentence containing *heed* as a verb (T6), though the sentence is grammatically incorrect. Ding's self-correction in this excerpt stimulated metatalk, generative use, and reflective repetition of *heed*. In Excerpt (18), Wen first produced an utterance containing the word *espouse* (T1) and then rectified her own utterance (T3). This self-correction process stimulated generative use of *espouse*.

(16) Ding & Zhong – Written Output – reconstruction – TWRE7: *acuity*
1. Ding:´acuity ((incorrect word stress)), *a´cuity* (WSRp; WMt), *a´cuity* (WSRp; WMt) [self-correction]
2. Zhong: he is a genius in many aspects
3. Ding: How can we use this word?
4. Zhong: in business he's acuity
5. Ding: No, this is a noun.
6. Zhong: it means he has acuity, acuity

(17) Ding & Zhong – Written Output – reconstruction – TWRE12: *heed*

1. Ding: But it didn't, heed means attention.
2. Zhong: Yes, because people still pay heed on Disney.
3. Ding: Pay what?
4. Zhong: Pay heed, attention, pay heed, but it's a *verb* (WMt), not… [self-correction]
5. Ding: Yes.
6. Zhong: But people still *heed* (WGU), *heed* (WRRp) on Disney. [self-correction]
7. Ding: heed on? heed on
8. Zhong: Disneys.

(18) Wen & Ma – Oral Output – reconstruction – TWRE13: *espouse*
1. Wen: … He espoused, espoused cartoons
2. Ma: espoused ((looking at the word from wordlist),
3. Wen: Oh, he made cartoons *espoused* (WGU) by the ordinary people through … [self-correction]

Discussion

Through analyzing Chinese EFL learners' conversations resultant from performing word-cued collaborative text-reconstruction tasks, this study shows that the learners engaged in six types of interactional process: co-composing of utterance, request for assistance, provision of help, other-correction, uptake, and self-correction, and that they performed co-composing of utterance the most frequently. These processes corroborated and went beyond those reported in Foster and Ohta (2005). Specifically, co-composing of utterance, other-correction, and self-correction, as found in this study, are the same as those in Foster and Ohta (2005), which investigated peer-peer interactions in the instructional context and did not focus on lexical learning. In contrast, the present study examined learners' interactions in performing collaborative text-reconstruction tasks and discovered three more processes: request for assistance, provision of help, and uptake. Uptake, as a step following other-correction, should be indispensable to collaborative output. In collaborative output performance, besides correcting each other, dyadic members would also seek assistance initiatively when necessary, followed by partners' provision of help. Thus, request for assistance and provision of help become possible consecutive occurrences within collaborative output. In short, the six types of interactional process reveal a reasonable and comprehensive picture of learners' interactions within collaborative output.

Additionally, the interactional processes of the study differ from the scaffolding strategies identified in previous studies. The assistance strategies, cognitive strategies, and scaffolding strategies found respectively in Mendoza (2004), Tocalli-Beller (2005), and Sahin (2007) manifest the various approaches that learners adopted in comprehending word meanings, and these approaches could be linguistic, contextual, cognitive, or social. Research (e.g., Tocalli-Beller, 2005) also recognized interactional strategies like information request and meaning negotiation used for working out word meanings from input. They look similar to the interactional processes identified in this study. Yet, the interactional processes of this study are unique in that they capture participants' interactions while completing a collaborative output task by using target words. Thus, participants' interactions were rather focused in accomplishing the task. Specifically five of the interactional processes (except co-composing of utterance) focused mostly on the meaning, form, and use of target words, sometimes on target ideas, and occasionally on language forms other than target words, while co-composing of utterance appeared as various ways of coping with utterances, either repeating, continuing, modifying or simultaneous producing, which involved word processing, too.

Therefore, pertaining to the association between learners' interactional processes and their word processing, the study found that participants' interactional processes mediated their word processing; that is, participants' interactions involved or brought about their word processing. Specifically, all six types of interactional process brought about all four categories of word processing, including word simple repetition (WSRp), word metatalk (WMt), word generative use (WGU), and word reflective repetition (WRRp) (Niu & Helms-Park, 2014). This suggests that collaborative output can lead to lexical learning because the interactional processes involved tend to bring about learners' word processing while learners' word processing has been found to be correlated with their

lexical learning (Niu, 2014; Schmitt, 2008). This finding explains the lexical learning effect of collaborative output found in previous empirical studies (Bruton, 2007; de la Fuente, 2002; de la Fuente, 2003; Ellis & He, 1999; Fernandez Dobao, 2014; Kim, 2008; Nassaji & Tian, 2014; Newton, 1995; Qi, 2001; Smith, 2004, 2005). Meanwhile, it reveals the source of the cognitive word processing involved in collaborative output as reported in Niu and Helms-Park (2014); that is, learners' cognitive word processing in collaborative output occurred within and through their interactional processes.

The finding about the mediating function of interactional processes indicates that L2 lexical learning within collaborative output takes place at both social and cognitive levels, in accordance with the sociocultural theory (SCT) of language learning (Lantolf, 2011; Vygotsky, 1978). At the social level, lexical learning is mediated through interactional processes; at the cognitive level, individual learners engage in cognitive word processing, which will affect their lexical learning directly. The social and cognitive levels are related in the sense that lexical learning is a process of moving from the social level to the cognitive level, constituting a continuous process. This process provides empirical evidence for the Vygotskian genetic law of cultural development (Lantolf, 2011; Vygotsky, 1978), which maintains that what learners obtain at the interpsychological/ social level will be internalized at the intrapsychological/ individual cognitive level.

A reciprocal relationship exists between learners' interactional processes and their cognitive word processing within collaborative output in that the former mediates the latter while the latter reacts on the former. On the one hand, learners' interactional processes acted as mediating tools (Lantolf & Thorne, 2006). Particularly, co-composing of utterance, request for assistance, provision of help, other-correction, and uptake could be regarded as mechanisms for social mediation, and self-correction as the mechanism for self-mediation. These mechanisms mediate learners' engagement with various types of cognitive word processing. On the other hand, the quality of learners' word processing may instigate different interactional processes. Further, learners' different types of cognitive word processing could provide various lexical learning affordances. Thus, learners' interactional processes and cognitive word processing interacted mutually, helping learners engage with target words to a greater extent and at a deeper level, hence leading to effective lexical learning.

To summarize, the above interpretation indicates that collaborative output could lead to lexical learning by pushing learners to do more and deeper cognitive word processing. This can stimulate learners' lexical learning mechanisms and create lexical learning conditions through the mediation of interactions.

Conclusion

This study of L2 learners' collaborative output performance revealed the interactional processes that learners engaged in, as well as how learners' interactional processes mediated their word processing. These findings suggest a picture of how the social level and the cognitive level of lexical learning are connected within collaborative output, reveal the underlying lexical learning mechanisms, and provide explanations for the lexical learning effectiveness of collaborative output tasks.

The present study is significant in several ways. Theoretically, it connects the social and the cognitive levels of lexical learning by using Vygotsky's sociocultural theory as its underpinning. This is a development of merely regarding lexical learning as a cognitive issue. Methodologically, the study employed a microgenetic analysis of learners' interactions, which makes it possible to examine the process of learners' task performances so as to reveal the interactional processes and connect interactions with word processing. Pedagogically, process analysis can help decide what tasks are effective for language learning, including lexical learning.

The study inevitably also has its limitations. Specifically, the text-reconstruction task is pedagogical instead of communicative, so the study may lack ecological value, but its pedagogical value cannot be denied. In addition, the findings about collaborative text-reconstruction tasks cannot be randomly generalized to other collaborative tasks. However, the research perspective and methods can be applied to investigating other relatively more communicative tasks like information-gap tasks and problem-solving tasks, or even classroom teacher-student interactions in future research, so that a sufficient understanding of how interactions mediate lexical learning can be achieved.

Notes

1. Two tasks were employed because there are generally two possibilities for collaborative output in terms of modality, and including both can help gain a more comprehensive understanding of the lexical learning within collaborative output.
2. The present study and Niu and Helms-Park (2014) are based on the same project. The latter reports quantitative results of a larger sample of Chinese EFL learners' cognitive word processing and lexical learning in collaborative output while the present study mainly qualitatively examines 8 Chinese EFL learner pairs' interactional processes and their mediation for word processing in collaborative output.
3. Data analysis revealed that both tasks incurred similar types of cognitive word processing and interactional processes. Thus the data from both tasks are quoted without the intention of comparing them when reporting the findings.
4. Critical turns are italicized with interactional processes and word processing being coded in square brackets and round brackets respectively for all excerpts in the paper.

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