

Expert-novice interaction as the basis for L2 developmental activity: A SCT perspective

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Abstract

This study investigated interaction between an adult EFL university student in Japan and her EFL tutor/researcher while they observed the student's L2 writing event during a stimulated retrospective recall session. Interaction is considered both a methodological instrument to investigate the complex cognitive activity underpinning L2 writing and a pedagogic tool to encourage linguistic – as well as strategic – awareness and change. Informed by Sociocultural Theory, this paper argues that interaction which is sensitive to learners' potential development can be a powerful tool to promote the co-construction of L2 knowledge. Data were collected through eye-tracking and real-time screen capture of the writing event and analysed using descriptive statistics and microgenetic multimodal interaction analysis. The paper aims to illustrate the potential value of a mixed-methods, multimodal, design to better understand the dual role of interaction: (a) to support development; and (b) as a methodological instrument to investigate the unfolding history of that development.

KEYWORDS: SOCIOCULTURAL THEORY; ZONE OF PROXIMAL DEVELOPMENT; INTERACTION; LANGUAGEING; MULTIMODALITY

Introduction

The goal of this paper is to showcase some of the linguistic, gestural, and material mechanisms and tools which appear to form the basis for L2 developmental activity in interaction. Crucially in this respect, a methodological concern underlies our study: In order to better understand the claim from Sociocultural

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Theory (SCT) that interaction is the source of learning and development (Lantolf and Thorne, 2006; Vygotsky, 1978), it is necessary to go beyond verbal analysis and investigate other vital aspects of dialogic interaction such as gaze, gesture and silence. We also argue that it is important to report the extent to which L2 developmental activity in interaction is observed within particular events; in other words, we need to determine the levels of developmental activity to assess the usefulness (or otherwise) of specific interaction activity.

Interaction, here understood as '*mediated joint activity*' (Lantolf and Thorne, 2006; van Compernelle, 2016: 174) represents a key mechanism for development. L2 development refers to the increasing and transformative ability to make use of the L2 to communicate as well as to mediate our understanding of the world through the lens of our enriched linguistic repertoires and competencies. It is in social interaction between 'novices' and 'experts' particularly, although by no means exclusively, that *zones of proximal development* (ZPD) can be effectively co-constructed through goal oriented, mediated activity (Lantolf, 2012: 60). Interaction, therefore, embodies the dialectics of development in that it is, in effect, the means and the outcome of development itself.

Theoretical background

Mediation, 'the process through which humans deploy culturally constructed artefacts, concepts, and activities to *regulate* (i.e., gain voluntary control over and transform) the material world or their own and each other's social and mental activity' (Lantolf and Thorne, 2006: 79) is at the heart of SCT. This Vygotskian concept holds the underlying foundations of the theory: All higher forms of mental activity, e.g., voluntary attention and conscious control and awareness, are mediated activity. The level of regulation can be determined based on the quality and quantity of support needed to exercise control over our material and psychological world. Thus, development can be assessed by taking into account the mediational mechanisms needed for regulation as described in terms of three recurring phases: (a) *object-regulation* refers to the stage where human activity is supported and even determined by objects in the environment; (b) *other-regulation* describes development supported by other people; and, finally, (c) *self-regulation* describes the capacity for independent strategic functioning (Lantolf and Thorne, 2007: 202–207).

It follows that in order to understand (L2) developmental processes and mechanisms as emergent in mediated activity, it is necessary to examine that activity as it evolves during our interactions with artefacts (material and psychological tools, concepts) and, importantly, with others. When it comes to the study of L2 interaction, certain concepts and mechanisms such as languaging, collaborative dialogue, and private speech have received considerable

attention from the research community, while others such as imitation, play, and gesture, less so. Interaction, therefore, represents the backbone of developmental activity as characterized in one of the most influential Vygotskian concepts: the *zone of proximal development* (ZPD).

The concept of the *zone of proximal development* is central to SCT discussions and research on interaction and has been widely adopted, adapted, and also misinterpreted (see Kinginger, 2001, 2002; Lantolf and Dunn, 1998). The ZPD was defined by Vygotsky (1978: 86–87) in terms of actual and potential development; he proposed that the essence of actual development is self-regulation, i.e., what the individual is able to do independently, while potential development represents what is beyond the independent understanding or problem solving abilities of that individual. Importantly, the ZPD is not statically defined by an outside task or piece of knowledge, but is part of a larger process that defines learning in terms of the ever-shifting needs of the individual and the amount and quality of assistance required (Lantolf and Poehner, 2011; Thorne and Hellermann, 2015). Therefore, the ZPD is seen as emergent in interaction, where assistance is contingent and finely attuned to individual needs during situated activity.

Broadly speaking, research on expert-novice interactions in the ZPD can be discussed in relation to two *complementary* approaches: (a) Work which can be described as interventionist since it aims primarily at operationalizing interaction and assistance in order to design conditions and environments which can be potentially conducive to the emergence of ZPDs, (e.g., Aljaafreh and Lantolf, 1994; Nassaji and Swain, 2000; Negueruela-Azarola, García and Buescher, 2015; Poehner, 2008; Poehner and Infante, 2015; van Compernelle, 2011); and (b) exploratory studies, such as the present one, whose primary aims are to understand in more detail *how* it is that expertise is co-constructed and *how* L2 developmental opportunities are emergent in situated activity (e.g., Gánem-Gutiérrez, 2008; Lantolf, Kurtz, and Kissalev, 2016; McCafferty, 2002; Mondada and Doehler, 2004; Steinbach-Koehler and Thorne, 2011; van Compernelle, 2016).

As a whole, research to date has led to the theorization and operationalization of fundamental concepts in SCT for research and practice. It has also resulted in a deeper understanding of the nuances of interaction that are, ultimately, the pillars for L2 development. The seminal study by Aljaafreh and Lantolf (1994), and its recent complement (Lantolf *et al.*, 2016), underline the essence of assistance in the ZPD as gradual (i.e., explicit-implicit continuum) and, importantly, contingent in interaction. Furthermore, these studies foreground the non-linear character of L2 development (Vygotsky, 1978); that is, an understanding of development as a dialectic between language performance and regulatory responsiveness (reciprocity) which necessarily results

in shifts in the quality and quantity of mediation afforded in the ZPD (see also Lantolf and Poehner, 2011).

As mentioned earlier, efforts have also been made to understand and evidence the dynamics of interaction (e.g., *how* interaction supports work in the ZPD) and which specific mechanisms are used by interlocutors during the co-construction of knowledge. Understandably, language itself (social and private speech) has been at the forefront of investigation; for example, Swain and colleagues have investigated the role of verbalization or, as Swain (2010; 2013) puts it, '*linguaging*' as a mediational tool for understanding. Throughout a substantial body of research they, and others (Donato, 1994; Gánem-Gutiérrez and Harun, 2011; Lapkin, Swain, and Knouzi, 2008; Negueruela and Lantolf, 2006; Swain, Lapkin, Knouzi, Suzuki, and Brooks, 2009) have demonstrated its importance in the (co-) construction of knowledge, particularly for metalinguistic purposes. There is also evidence of the role of semiotic tools such as discourse markers (e.g., and, but, or, oh, now, etc.) (Gánem-Gutiérrez and Roehr, 2011) and repetition for reasoning, achieving intersubjectivity and/or scaffolding purposes (DiCamilla and Antón, 1997; McCafferty, 1994; Roebuck and Wagner, 2004).

More recently (although see McCafferty, 1998, for pioneering work), the role of gesture (and other non-verbal actions) in L2 interaction in general and in the context of work in the ZPD has started to gain attention. The connection between language and gesture for meaning making and cognition, e.g., signalling that one wants to add information, showing difficulties in speech production, to facilitate retrieval of lexical items, or for listeners to indicate that they are actively engaged in the conversation, is well recognized among gesture scholars (see Stam and McCafferty, 2008: 8). More specifically, and based on McNeill's (1992) classification, McCafferty (2002) found certain gestures to be prominent in the construction of ZPDs. For example, 'iconic' gestures (representing actions or objects), 'illustrators' (which accompany and support verbalization) and 'deictic' (pointing) gestures helped interlocutors enhance comprehension and scaffold the co-construction of meaning by reducing ambiguity or referencing objects in the environment in the case of deictic gestures, thus facilitating communication and leading to intersubjectivity and, ultimately, self-regulation. Interestingly, McCafferty (2002) also found imitation and synchronicity of gestures between his interlocutors, actions which appeared to have helped in creating a sense of shared context and interpersonal rapport (Chamberlin Quinlisk, 2008; Gullberg and McCafferty, 2008; Lantolf, 2010; McCafferty, 2006, 2008; Negueruela and Lantolf, 2008).

Finally, rooted in ethnomethodological Conversation Analysis within SCT, Mondada and Pekarek Doehler (2004) and, more recently, van Compernelle

(2016) have provided detailed accounts which evidence the situated nature of cognition and developmental activity as they are embodied and emergent in social interaction. The work of these scholars demonstrates the intricacies and multi-layered nature of interactional activity; this activity is shaped ‘in situ’ and leads to learning and development based on the interlocutors’ orientations at specific moments, through specific mediational means as they become available during interaction and in pursuit of shared goals and actions (van Compernelle, 2016: 174).

In sum, and as hopefully shown through this selective overview of interaction research, SCT offers a strong set of theoretical as well as methodological tools, e.g., (micro)genetic analysis, for the study of L2 development as an intrinsically social activity. Considerable efforts have been made to understand and evidence the role of certain mediational mechanisms supporting the co-construction of ZPDs. However, speech has tended to be the focus of research, while documentation of the subtlety and intricacies of various other aspects of interaction (such as its embodied nature and the role that physical tools and environments play during the unfolding of developmental activity) has not received the same level of attention. This study aims to contribute to the field by relying on: (a) a research design which, true to Vygotskian praxis (Lantolf, 2008), we trust demonstrates the inseparability of theory, research and action while also exploiting the power of technology (as tool and ‘participant’ in interaction); and (b) a combination of descriptive (microgenetic multimodal interaction analysis) and quantification of developmental activity in order to offer a fuller perspective of a pedagogical event. To that aim, we address the following research questions:

- RQ1: To what extent did interaction during stimulated retrospective recall support developmental opportunities?
- RQ2: How exactly did interaction during stimulated retrospective recall bring about developmental opportunities?

The study

Participants and context

The participants were ‘K’, an adult (female; L1 Japanese) EFL student at a Japanese university and ‘A’, an EFL tutor/researcher. K had been learning English for seven years and her self-reported writing expertise was assessed as intermediate which was in agreement with her L2 proficiency level as determined by a cloze test (C-Test) (Grotjahn, 2010) constructed by the author; the C-Test consisted of 116 items based on text extracts from *Headway English* series of textbooks (see Gilmore, 2011); K gained a score of 63.79%. Data (obtained with full consent) were collected at the university office of one of the

co-authors over two days (see below). The overarching purpose of the session was to discuss and understand the ‘history of an L2 writing event’.

Data collection procedures

On day 1, K completed the C-Test. Day 2 consisted of two phases: First, K was familiarized with the hardware and software and various online resources: Web browser, monolingual and bilingual dictionaries and thesaurus since K was allowed to access them at any time during the composing process; then the eye-tracker (see below) was calibrated. Subsequently, K was given 10 minutes’ planning time for writing an IELTS style argumentative essay (this period is not included for analysis in this paper). The essay topic was ‘Education should be free for everyone. To what extent do you agree or disagree with this statement?’ K was given 35 minutes to write the essay. In order to unobtrusively capture the moment-to-moment L2 writing event, an eye-tracking suite (Tobii T60/Studio 2.2¹) was used to produce a real time visual record of the whole writing process as well as to gather eye gaze activity during the composing period.

The second phase consisted of stimulated retrospective recall (SRR). Following general guidelines on this type of methodology (Gass and Mackey, 2000), the SRR protocol was initiated after a 10 minute break while the writing event was still fresh in K’s memory; this phase was also recorded with Tobii Studio 2.2. K received the following instructions: ‘We will now watch your composition video and I would like you to talk me through what was going on in your mind as you were writing your essay. You can press the pause button whenever you want to make a comment and, if I pause, I would also like you to tell me what you were thinking at the time.’ The SRR activity (and therefore video recorded data) lasted one hour and 26 minutes; data were transcribed in full to produce a protocol for subsequent analysis (see below).

Data analysis procedures

In order to address RQ1 (the extent to which interaction during stimulated retrospective recall supported developmental opportunities), we conducted descriptive statistical analysis of the SRR event, with all data managed and analysed in Elan² v.4.8.1 (Wittenburg, Brugman, Russel, Klassmann, and Sloetjes, 2006).

Initially, the SRR video was segmented into verbal and non-verbal episodes. All verbal episodes (i.e., segments of talk on specific issues or *topics*, e.g., lexis, grammar, essay structure, style, planning, use of material resources such as paper notes or online dictionary, etc.) were transcribed in full and a system for classification according to *topic foci*,³ on the one hand, and episode *type*, on the other hand, was developed as follows:

Verbal episodes by type

1. *Transactional (or procedural) episodes*: Episodes where the learner and tutor talk about and/or describe the writing event, but there is no pedagogical focus (see Appendix for an example).
2. *Languaging (developmental) episodes*: Following Swain (2010), episodes where language is used to mediate cognitive activity and thus, opportunities for knowledge construction or knowledge enhancement emerge (see Appendix and Findings section for an example).

Non-verbal episodes refer to segments of video watching activity where the student and tutor are silently watching the playback of the L2 writing event.

Both authors independently coded *all* verbal episodes (inter-rater agreement was excellent at 94% over 86 decisions) and intra-coder agreement (97%) by one of the authors was also calculated by re-coding the data after a six-month interval. Finally, descriptive statistics were calculated (see Findings section) using Elan and MS Excel.

In order to address RQ2 (how interaction supported developmental opportunities), we conducted multimodal interaction analysis. This type of analysis requires a focus on the various semiotic resources such as language, non-linguistic behaviour, gaze, facial expression, gesture, head and body movement and orientation as well as tools (e.g., computer, paper notes); settings (e.g., tutor's office); roles and relations (e.g., expert-novice); and situated activity systems (e.g., goals, practices) (Nishino and Atkinson, 2015: 41–42) which mediate communication, understanding and, ultimately, development. Multimodal interaction analysis is also compatible with the Vygotskian *genetic* (historical) method (Lantolf and Thorne, 2006); more specifically, microgenetic analysis as a means to trace the moment-to-moment emergence of a developmental event and its sources by tracing changes in functioning (Lantolf and Poehner, 2014: 24).

Findings

The first research question focused on the extent to which interaction during stimulated retrospective recall supported developmental opportunities. As outlined above, once the episodes identified throughout the SRR event had been categorized, descriptive statistics were calculated in order to address this question. We examined the data both in terms of number of episodes giving rise to different types of activity, non-verbal and interactional (which included *transactional or procedural* episodes vs *languaging or developmental* episodes) and in terms of the actual time spent on such activity, see Table 1.

Table 1: Tutor-student activity during stimulated retrospective recall (SRR)

Episode type	Non-verbal	Verbal		Total
		<i>Procedural</i>	<i>Languaging</i>	
No. episodes % vs (raw)	53% (98)	37% (67)	10% (19)	100% (184)
Time %	36.6%	35.9%	27.5%	100%

As evident in Table 1, the occurrence of procedural activity was much higher than that of *languaging* (in raw figures: 67 vs 19 episodes, respectively), but the latter type of episode lasted considerably longer in terms of time, which explains the fact that almost a third of the SRR (27.5% of the time) provided *languaging* or developmental opportunities for the student. The opposite pattern was observed for non-verbal activity with a higher proportion of occurrences (98 episodes or 53%) which, nonetheless, resulted in a lower percentage if these are examined in terms of *time* (37%). In sum, the results suggest that *languaging* as part of interactional activity during stimulated retrospection brings about important L2 developmental opportunities, 10% of the overall number of episodes, but a considerable amount of time (27.5%). Notably, the analysis we presented highlights the importance of examining and reporting both frequency of occurrence as well as time spent on a given type of activity when working with verbalization protocols in order to offer a fuller and more accurate account of that activity.

A second concern of this paper was to investigate *how*, exactly, interaction during stimulated retrospective recall may bring about L2 developmental opportunities. To address this question, we will now examine one of the 19 *languaging* episodes through the lens of *microgenetic multimodal interaction analysis* (see Data analysis procedures above). Although the chosen episode is inevitably unique, the developmental mechanisms drawn upon as the basis for activity within the ZPD, and which are exemplified through this particular episode, are representative of their *type* in our data.

Technology mediated joint attention

As described in ‘The study’ section above, the overarching goal of the SRR task was to understand complex cognitive activity underlying L2 writing processes. In this context, our focal *languaging* episode (transcribed in full in the Appendix) is preceded by both a non-verbal episode where tutor and student are watching the writing process as it unfolds (Figure 1) and a *transactional episode* (also transcribed in full in the Appendix). The SRR playback of the L2 writing event shows that after writing ‘I think’ at the end of

the fourth line in her text, K re-reads the sentence and fixates her gaze on the word ‘appreciate’ as shown by the eye tracker during the L2 writing event (pink circle) and the accompanying heat map⁴ produced subsequently for analysis purposes; the video also shows ‘appreciate’ underlined in green by the word processor.

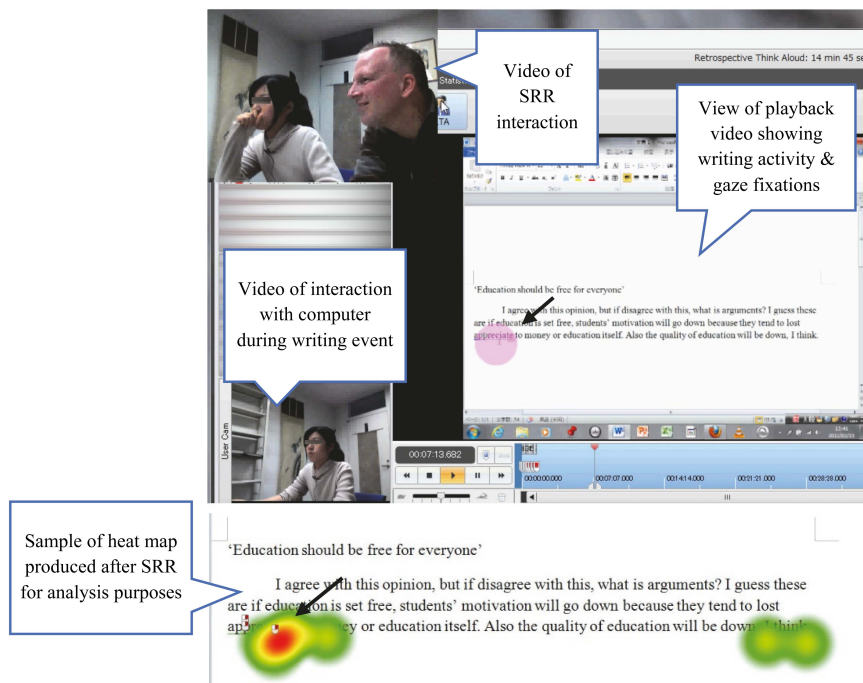


Figure 1: The origins (Note: The figure shows main sources of data available to the researchers for analyses purposes).

They continue watching for a few seconds and then the grammar checker appears on the screen (see Figure 2), this triggers A to stop the playback, asking: ‘what’s happening here?’ while still looking at the screen and, thus, sustaining attention onto the issue in question.

Through the *transactional episode* that follows (see Appendix), it is established that K noticed (hence the gaze fixation) that MS Word was highlighting an issue (green underline) and, therefore, she right-clicked to bring up the grammar checker. They continue watching the video for nine seconds which shows K’s object-regulated action as she chooses the word ‘appreciating’ offered by the word processor; this is not the correct form in this context either.

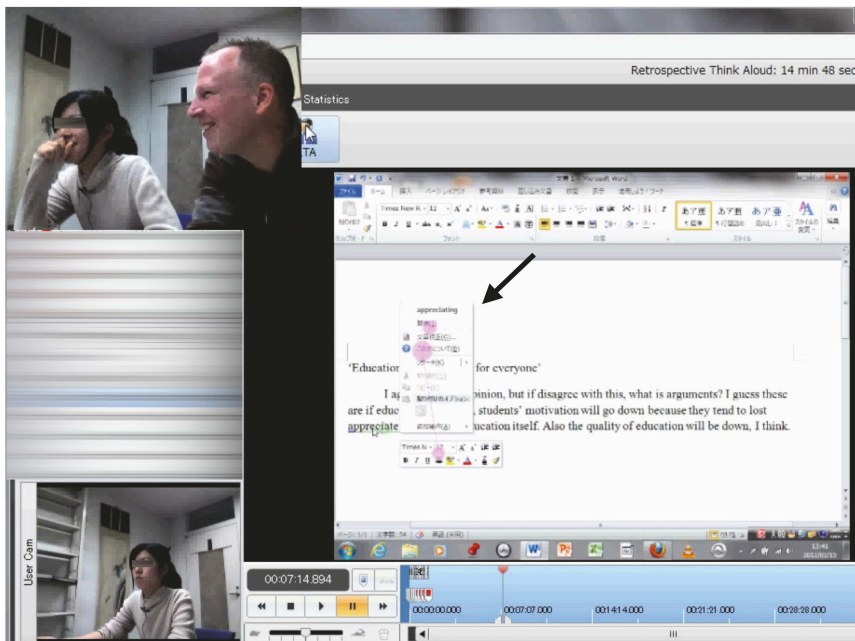


Figure 2: Object-regulation

Seizing the moment (or what experts do): Language

The technological tools (computer, word processor, video playback, eye-tracker) played an essential role both in revealing the process leading to a particular (and, in this case, unsuitable) language choice as well as increasing awareness of the specific L2 issue. It is, nonetheless, A's pedagogical sensitivity and expertise that seizes the opportunity to activate both technological and psychological resources to open the way for change.

First, by stopping the playback, A creates the opportunity for metacognitive (e.g., reflection) and metalinguistic activity to take place; the action of stopping the playback is in itself a form of invitation to K and a preliminary orienting step towards the key issue: “yeah” actually (0.2) yeah the, you want the noun here don’t you.’ Through the particle (‘um::’), K shows an orientation to speaking response. A probes further with the leading question: ‘which is?’ and, at this point, the interlocutors’ attention moves away from the computer screen as they continue co-building a ‘pedagogical space’: A turns towards K, K adopts a pensive stance (tilting head, hand to chin and mouth, gaze into the distance, as shown in Figure 3) (see Stam and McCafferty, 2008) and, crucially, A waits (silence/pause of 1.2 seconds).



Figure 3: Thinking space

After the 1.2 seconds pause, and still looking into the distance, K offers an unsuitable alternative for the context: ‘appreciate’ and, importantly, turns to look at A as soon as she finishes uttering the word, an action which appears to seek A’s feedback (*cf.* Goodwin, 2000; van Compernelle, 2016). After a couple of seconds A responds with further help in the form of contrastive stress for the metalanguage: ‘that’s a verb’. They exchange a couple of acknowledgement markers (‘ah’, ‘yeah’), A waits and then the dyad’s efforts bear fruit as evidenced in K’s achievement by, finally, producing the right form: ‘appreciation’, which is retrieved through some apparent extra cognitive effort as suggested by the phoneme lengthening and short pause before the production of the crucial noun-forming bound morpheme: ‘apprecia::(.)tion?’ (see line 11 in the Appendix). A then uses a combination of linguistic (‘uh hum yeah’, ‘that’s it’) and non-linguistic (keen nodding, smiling) communicative actions to support K’s knowledge building and, presumably, help her build up confidence.

Seizing the moment (or what experts do): Writing tools

After a little ‘celebration’ of K’s L2 achievement through simultaneous laughter (shown in Figure 5), A continues to take advantage of the event and this time brings into focus the tool (grammar checker) issue. Once again, a combination of resources (language, gesture, ‘play’) are deployed to delve into the process and reveal cognitive activity underpinning that process. Deictic gestures

(McNeill, 1992) (together with giggling and laughter) are prominent throughout the last moments of activity in this episode (Figures 4 and 5).



Figure 4: Pointing

Although both interlocutors use the pointing gesture for communicative as well as cognitive functions (see below) (McCafferty and Stam, 2008: 11), there seem to be subtle differences in their individual use. In line 19, K seems to use pointing to reveal her psychological subject (i.e., the computer/word processor/grammar checker): ‘yeah ((K laughs softly)) I’ve (0.3) yeah ((**pointing at screen**)) I (1.0) apprecia:ting is (1.0) I (0.9) haven’t (.)seen the appreciating=’. In contrast, in lines 27–28 her gesture (shown in Figure 4) accompanies the verbalized subject while blaming the computer: ‘((giggles)) but ((giggles)) it’s ((**giggles and points to screen**)) (1.5) computer suggest me ((laughs))=’. In line 15, A seems to also make use of the gesture (shown in Figure 4) simultaneously for communication and, interestingly being the native speaker, as a cognitive aid, in his case to what appears to be an effort to retrieve the noun phrase: ‘the suggestion’. We believe evidence for this conclusion can be found in the repetition of the article while pointing as well as the discourse particle uttered (um): ‘so actually [the the the ((**pointing at the screen**)) um the suggestion it gave you is wrong yes’. Thus A seems to be also using the gesture for self-regulatory purposes (McCafferty, 2002; Negueruela and Lantolf, 2008) while also providing visual support along with his utterance.

The final aspect we would briefly like to highlight in relation to the mechanisms supporting the co-construction of what we argue constitutes a developmental opportunity, i.e., the episode in question, is ‘playfulness’ (Lantolf, 1997), or a form of play and affiliative behaviour as embodied in smiling, giggling, laughter. These expressions of jollity accompany two aspects of the episode: (1) as mentioned above, there is a burst of laughter as a means of ‘celebration’ and release of ‘tension’ signalling that a problem has been resolved when K utters the required word, ‘appreciation’, shown in Figure 5; and (2), giggling, smiling, and laughing are prominent around the issue of ‘blame’ towards the grammar checker, which made an inappropriate suggestion in



Figure 5: 'Play'

relation to the specific writing context. Once again, however, nuances in co-action are evident. While there is mirroring behaviour between the student and the tutor, the playfulness in giggling and laughing seems to play slightly different roles in the interaction; for K, giggling seems to help her soften the fact that her 'blaming' the computer for choosing an inappropriate form could be interpreted as using an excuse and, linked to this, the giggling and (1.5 second) pause before she produces an account: 'computer suggest me' in line 28 (see Appendix) seems to accompany a sense of embarrassment or 'delicate' moment (Glenn and Holt, 2013a: 15). In the case of A, he uses laughter as an alignment behaviour with K (coorienting) and as a mechanism to sanction the 'blame' assigned to the tool (stance-taking) (see Fatigante and Orletti, 2013) and, as such, also a mechanism for supporting her emotionally; thus simultaneously enacting social ('friend') and tutoring (expert) roles.

Discussion

The theoretical assumption underpinning this study lies in a view of interaction as joint activity where zones of proximal development can be forged. From a SCT perspective, learning and development are mediated *in interaction* by culturally constructed artefacts, such as language, concepts, and also material tools. Following from this, the dual goal of our study was to ascertain the extent to which developmental opportunities emerged in the context of

SRR on the one hand (RQ1) and, on the other, to examine L2 developmental activity in interaction in order to identify the specific tools and mechanisms mediating regulatory processes (RQ2).

The episode analysis we presented above represents an example of successful interaction; in other words, the excerpt demonstrates the key aspect of work within a ZPD: mediated activity supporting change through contingent assisted performance and, crucially, co-action. A, in his capacity as 'expert' was able to accurately gauge K's actual development and to carefully attune his expertise in order to successfully orient her into future 'proximal' development, along an implicit-explicit continuum of mediation also noted in other studies (Aljaafreh and Lantolf, 1994; Lantolf, 2012). For that to have happened, a complex array of intra-personal (cognitive) and inter-personal (social) functioning had to take place (Vygotsky, 1978). A's mediation involved 'drawing attention to certain features of phenomena, interpreting the meaning of objects and events, and making connections across phenomena and experiences' (Lantolf and Poehner, 2014: 161), but this is, of course, only part of the story, for developmental activity to emerge it is also necessary that the 'novice' is able and willing to co-act. As evident throughout the episode, K's activity is permeated by 'active reception' (Lantolf 2007, 2011b) and 'participation' (van Compernelle, 2015; Van Compernelle and Williams, 2013) through:

- (a) Commitment and orientation to the task;
- (b) Expressing intentionality, e.g., by explaining reasons for actions;
- (c) Showing general willingness, e.g. making efforts to elaborate on comments;
- (d) Willingness (and ability) to engage in metacognitive activity, e.g. reflection on task and action;
- (e) Striving to assign relevance and significance to things and events.

In sum, development cannot be studied in isolation from affect and volition (Wertsch, 1998). Importantly, our case study showed that such developmental opportunities did not represent isolated occasions, but amounted to 10% of the total number of episodes in the data (including non-verbal) and a considerable 27.5% of the total SRR time. Unfortunately, given the importance of such information, we could not identify studies reporting similar quantitative data and, therefore, cannot offer any comparisons in this respect. We will now discuss some of the key mechanisms and tools that mediated L2 developmental opportunities.

Languaging

Discussions and debates on the 'usefulness' of a learner's conscious knowledge of language, e.g., metalinguistic knowledge, tend to centre on exactly

what this type of knowledge can be used for (see Ellis, 2004). Our microgenetic analysis shows an example of effective use of metalinguistic knowledge in relation to morphology even if *use* in this case does not refer to spontaneous language production, but to guided or elicited performance. The episode shows that K's knowledge of the lexical item 'appreciate' is in a state of flux: Clearly, she already had some knowledge in relation to its semantics and morphology and also knew what the metalinguistic terms 'verb' and 'noun' denote. It is this combination of knowledge that A managed to effectively activate so that K could successfully *use* it as a psychological tool to produce the appropriate form, 'appreciation'. The characteristics of speech delivery as detailed in the analysis above; that is, phoneme lengthening and short pause in 'apprecia:.(.)tion?' point towards this type of *use*, i.e., a transformative application of discrete (declarative) knowledge into a successful form-meaning unit ('appreciation') rather than a mechanistic search and eventual retrieval of form(s) from memory. In other words, we suggest that if the various forms (appreciate, appreciating, appreciation) had been memorized by rote learning, for example, there would not have been a need for 'thinking time' before the target morpheme was produced. Thus, the *language* rooted in interaction during SRR, demonstrates the kind of dialogic activity believed to support internalization (Swain, 2000, 2010).

Non-verbal behaviour, laughter and 'playfulness'

Eye gaze, body posture, gesture and, as our data also show, silence at critical points (i.e., 'chronemics', (Chamberlin Quinlisk, 2008: 28) during interaction are powerful tools for the co-construction of ZPDs. As shown in the analysis above, and in L2 studies which have analysed non-verbal behaviour, these features play a key role both for communication and cognition. They have been found to be used for example, as reinforcing mechanisms 'through gestural illustration and redundancy' and to highlight L2 features at linguistic and discourse levels which could assist with information processing (see Stam and McCafferty, 2008: 15–18). Particularly relevant to our study, they are considered to be critical in the creation of ZPDs since they appear to play a key role in the creation of intersubjectivity; that is, they seem to contribute 'to developing a sense of shared physical, symbolic, psychological, and social space for the participants' (McCafferty, 2002: 201). Thus A and K's gestures and body posture continuously signal attention to each other (and to the computer as a '3rd participant') leading to what has been described as 'active reception of L2 affordances and participatory engagement in interaction' (van Compernelle, 2015: 131).

In the same vein, the importance of playfulness and laughter are well studied and documented mechanisms in social interaction in general (see Glenn and Holt, 2013b), although relatively less so in L2 learning studies (but see Tarone,

2000). Our analysis suggests that laughter in its various manifestations is used primarily as a mechanism for maintaining intersubjectivity and, thus, supports a complex and delicate display of sociocognitive and affective co-actions. Importantly, for K, giggling appeared to be enabling her to expose and explain cognitive decisions leading to her lexical choice, behaviour which lends support to a view of emotion as being inseparable from cognition (Streeck, Goodwin, and LeBaron, 2011) and which also relates to current work on Mediated Development: L2 development being a cognitive-emotive process (see Swain, 2013; Poehner and Swain, 2016). While SCT studies of playfulness have primarily focused on play and private speech, e.g., L2 learners 'playing' with language, sound, and/or rehearsing through self-directed speech (Lantolf and Thorne, 2006: 190; McCafferty, 2002; Ohta, 2001), we believe that a broader view of this potentially key mechanism should be considered and further studied.

Physical tools

Finally, our analysis demonstrated the key role played by physical tools mediating the co-creation of ZPDs. Specifically, the computer was pivotal in this L2 writing event; physically, it provided a focal area for the student and tutor to orient interaction and it also provided the tools (word processor, grammar checker, eye-tracker software) upon which cognitive and affective processes evolved. Although computers have been at the centre of research into L2 writing (Park and Kinginger, 2010) and computer-mediated communication/interaction (Stickler and Shi, 2017; Stickler, Smith, and Shi, 2016), much less is known about (expert-novice) interaction *at* the computer and, in that respect, our study (and its methodological design) offers insights into interaction activity which would be difficult to explore otherwise. Of particular importance, in our view, are the insights into the way in which the grammar checker regulated K's L2 writing activity on the one hand, and on the other, into the way in which the representative focal event opened up developmental opportunities. Although these were led by the expert, who among other things fostered a sense of agency (Lantolf, 2012: 60), for example by helping K see that computers are not necessarily 'right', ultimately, those opportunities were co-constructed by the dyad in situated activity. As we have seen, these affordances did not exclusively relate to language, but also to the tool itself: this is key in an age when such tools are part and parcel of the (L2 writing) activity for so many learners.

Conclusion and pedagogical implications

What makes SCT a 'powerful alternative' to cognitivist paradigms such as the interactionist approach to L2 learning is its 'nonreductive framework in

which the internal-psychological and the external-social are brought together [through the process of internalization] as a dialectical unity' (van Compernelle, 2015: 6). Within this framework, interaction is the source and product of L2 development. It is not our intention to claim that episodes such as the ones exemplified in our case study necessarily represent full internalization. Our aim was to investigate developmental activity; that is, activity resulting in the co-creation of ZPDs during stimulated retrospective recall. Our study does claim that developmental opportunities emerged during SRR and it looked into how these emerged – findings which have important pedagogic and methodological implications. Pedagogically and, unsurprisingly given the key Vygotskian concept of praxis, this study, we believe, demonstrates the 'unity of theory and practical activity as an instrument of change' (Lantolf and Beckett, 2009: 459) where a tool for research, i.e., SRR, is simultaneously a tool for change, i.e., (potential) development. Importantly, the implications of this fundamental tenet of SCT are far reaching and raise methodological concerns for research in applied linguistics and L2 learning relying on languaging as a tool for data collection. This is because all verbalization and, by definition SRR, is dialogic; an issue highlighted some time ago by SCT scholars (Lantolf, 2012; Smagorinsky, 2001; Swain, 2006), but which to our knowledge, remains mostly unacknowledged outside this theoretical framework.

Second, we believe this study provides further insights into the distributed nature of cognitive functioning as attested by the various tools and mechanisms (physical and psychological): computer, video, grammar checker, pauses, gaze direction, gesture, languaging, 'play', tutor's leading questions, prompts, hints, waiting, and use of metalanguage implicated in the mediated work forging the co-construction of ZPDs (e.g., van Compernelle, 2015). Third, and related to this point, while many tutors, particularly experienced ones, tend to instinctively make use of some of these mechanisms to promote L2 development, studies such as the present one can, hopefully, enhance awareness among practitioners and could even lead to the development of pedagogical materials (for some pioneering work along these lines see Hamel and Séror, 2016). Finally, we have attempted to highlight the importance of conducting (micro-genetic) *multimodal interaction analysis* (see Nishino and Atkinson, 2015, for a socio-cognitive perspective; and van Compernelle, 2016, CA-for-SCT) if we are to gain further insights into the complexity of interaction in L2 contexts.

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Notes

1. Tobii technologies for eye tracking consist of a suite of hardware and software (e.g., micro-projectors, gaze sensors and image-processing algorithms) which *unobtrusively* monitor and record eye movement and gaze. As researchers, we can obtain a very rich record of participants' looking behaviour both visually by means of a replay facility as well as statistically, for example of frequency and length of time (fixation) spent looking at a word or screen region. This information is particularly useful to study writing and reading processes. We also used the facility to video record the participants' activity: (a) while the student was composing the essay *on* the computer; and (b) while student and tutor were interacting *at* the computer during the stimulated retrospective recall session. For further information see www.tobii.com/tech.

2. Elan is a freely available piece of software for complex segmentation, annotation and transcription of audio and/or video resources and was created by The Language Archive, Max Planck Institute for research purposes. Once the data have been annotated, the programme also produces statistical information based on time-stamps. For further information see <https://tla.mpi.nl/tools/tla-tools/elan>.

3. Not relevant to this paper.

4. A heat map is a visual representation of the gaze fixation level; red colour represents the highest level.

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Appendix

Example of 'transactional episode'

1 A What's happening here. ((looking at the screen))
 2 K um: ((giggles)) I mistook (0.5) the ((giggles))
 3 A yeah so you you right-clicked ((pointing at screen
 4 and moving finger up and down)) (0.3) did you?
 5 K =yes ((still giggling))
 6 A =yeah((looking attentively at the screen))(2.2)so
 7 you saw the green line ((uses iconic gesture:
 8 moves finger right and left repeatedly as if draw-
 9 ing a line while also looking at K))
 10 K [mm ((nodding))
 11 A [yeah uh huh

Example of 'linguaging episode'

1 A ((A and K watching video, then A stops playback)
 2 °yeah° actually (0.2) yeah the, you want the noun
 here don't you.
 3 K [um::
 4 A [which is? ((turns to look at her and waits)) (1.2)
 5 K ((K adopts pensive gesture: tilting head, hand goes to
 6 chin, distant gaze)) a (3.8) ppreciate  ((turns to
 look at A as soon as she finishes uttering the word))
 8 A (2.1)that's a verb (0.5)
 9 K ah ((nods slightly))
 10 A yeah (0.8)
 11 K apprecia::(.)tion? ((K turns to A as she utters last
 12 syllable and giggles))
 13 A uh hum: yeah ((nodding keenly)) that's it ((A
 14 smiles and they laugh together)) (0.9) so actually
 15  [the the the ((pointing at the screen)) um the sug-
 gestion it gave you is wrong yes (0.7)
 16 K [um
 17 ah::=
 18 A =yeah um

19 K yeah ((A laughs softly)) I've (0.3) yeah ((pointing
 20 at screen)) I (1.0) apprecia:ting is (1.0) I (0.9)
 21 haven't (.)seen the appreciatinging=
 22 A =um
 23 K So (0.5)I (0.2)um (0.6)appreciate (1.3) I think
 24 it's (.) verb((turns to A))[and or verb and (0.6)
 noun?=
 25 A [yeah
 26 =yeah (.) uh huh
 27 K ((giggles)) but ((giggles)) it's ((giggles and
 28 points to screen)) (1.5) computer suggest me
 ((laughs))=
 29 A ((turns to K)) =ye::ah it it it was (.) it gave you
 30 bad advice ((smiles and laughs with her)) (.)yeah
 31 appreciatinging is just the verb the -ing form of the
 verb yeah

Transcription conventions adapted from Clift (2016: 53–63)

[Indicates a point of overlap onset, whether at the start on an utterance or later
=	Indicates no discernible silence between speaker lines
(0.5)	Silence in tenths of a second (as measured in Elan)
(.)	A micropause
?	Rising intonation
,	Continuing intonation
:	Indicates the prolongation of the sound preceding them
<u>word</u>	Indicates stress or emphasis
↓ ↑	Indicate sharp rise or fall in pitch
(())	Transcriber's description of events
°°	Indicates that the talk between the degree signs is softer than the talk around it