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Collaborative corrections with spelling control: Digital resources and peer assistance

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Abstract The present study has explored how pairs of students deployed digital tools (spelling software) as resources in spontaneously occurring corrections of spelling errors. Drawing on the sociocultural theory of learning and ethnomethodological (Conversation Analytic) insights into social interaction, it has identified a range of consistent practices and uses of the spelling tools that were emergent in the everyday educational activities. As demonstrated, technology-assisted error corrections constituted a complex situation, where a number of socioculturally significant factors (goals of the task, properties of the software, and physical access to computer applications) shaped the trajectories of joint work. The present analysis shows in detail how the students approached the visually manifested language production errors by using two kinds of software resources, spelling lists, and a diagnostic tool. The inherent conceptual distinctions, characteristic of these tools, configured joint interpretative work and efforts to correct the errors in different ways. Recurrently, the students' technology-based corrections were designed as autonomous, stepwise, locally improvised problem solutions, which were subsequently submitted for the evaluation of the diagnostic software. Overall, the study shows that the under-specification of the software's instructions opened a space for the students' creative engagement. The potentials of joint spelling software-assisted corrections for collaborative learning are discussed.

Keywords CSCL · Sociocultural theory · Interaction analysis · Error corrections · Spellchecker technological tools

Introduction

Group work and the use of digital technologies, including spelling control during computer-assisted writing, as part of joint activities are becoming a recurrent and routine feature of

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everyday work and study in educational settings. Technology, however, is not simply out there in the world, rather it has a potential influence on users' work and actively contributes to sustaining specific manners of reasoning, learning, and collaboration (Cole 1996; Säljö 1999; Wertsch 1991). Understanding the use and implications of such tools is inextricably related to the exploration of how people interact with, around, and through them as part of their attempts to use the technology. Rather than corresponding one-to-one to the design features implemented in the technology, their functions reveal themselves through humans' attempts to use the artefact and emerge in the context of material encounters between actors and objects (Hutchby 2001, p. 157; Koschmann 2002; Säljö 2004). The potential of technological tools for joint work and study, as argued by the *dialogic* approach to CSCL (Arnseth and Ludvigsen 2006), can be revealed through a close exploration of their "usability," that is, how students themselves constitute the meanings and functions of computer applications as part of situated teacher-student and/or student-student interactions. Given the recent development and the wide-ranging applications of the spelling software in word processing programs (Grossen and Pochon 1997), the potentials of these resources as they are deployed in educational settings deserve close attention. So far, research on spelling software has primarily focused on the effectiveness of such tools in experimental settings (Heift and Rimrott 2008; Ndiaye and Vanderventer Faltin 2003).

Drawing on the sociocultural theory of learning and ethnomethodological (Conversation Analytic) insights into social interaction as coordinated meaning-making practices (Heritage 1984), the present study explores Swedish 8th graders' collaborative work with spelling software. Pairs of students were recorded while engaged in authentic spelling error corrections, spontaneously occurring during English-as-a-second-language (ESL) collaborative writing sessions. Corrections of software-detected spelling errors constituted a form of ad hoc problem solutions evolving during a joint activity. Adopting a broad and socially sensitive definition of CSCL as "joint meaning-making practices within the activity supported by technological tools" (Koschmann 2002), the present study aims to investigate how students appropriate technological resources to meet their needs during their work on classroom assignments. More specifically, it aims to identify the recognizable and shared practices of the participants and to discover a range of ways in which spelling tools are exploited as resources in collaborative spelling error corrections. The point is to illustrate the kind of meaning-making practices the students engage in as they employ a variety of technological tools, taking into account how these tools are acted upon in collaboration.

The insights and analytical mentality of Conversation Analysis adopted in the present study are argued to provide a potentially productive contribution to the study of computer-supported learning activities (Greifenhagen and Watson 2009; Stahl 2005). The present approach allows an exploration of collaboration, meaning-making, and interaction via, around, and through computers as socially organized (rather than intra-individual) phenomena, observable and publicly manifested in participants' perspectives, that is, participants' analysis of verbal and nonvocal actions and contributions (Goodwin 2000; Greifenhagen and Watson 2009; Koschmann 2002). The specificities of interaction in an activity context involving technology are acknowledged: The foremost specificity concerns the conceptualization of agency as compared to ordinary conversational interaction. A technological artefact, rather than being attributed elements of active interactional participation, understanding, and meaning making (see Frohlich et al. 1994), is viewed as one of the resources around and through which users' meaning making evolves. The outputs ("contributions") of the technological resources are conceptualized as objects and meaning-making availabilities that are incorporated into active and collaborative sense making on the part of humans (Hutchby 2001, p. 2).

More particularly, the present study focuses on the students' collaborative attempts to correct and remedy spelling errors that are detected and visually highlighted by the spellchecker on the screen.[1] Such errors are defined as *visual trouble sources* that index misspelled words/language production errors as "things that visibly went wrong for the participants on the screen" and needed a correct replacement (Greifenhagen and Watson 2009; see also Jefferson 1987).[2] The questions explored specifically are: When the students use spelling control, what methods and resources do they deploy to find an adequate remedy for the trouble source? And, how does the deployment of different spelling tools configure the students' collaboration? Furthermore, I will discuss the potential implications of these practices for collaborative learning.

Sociocultural theory

One of the fundamental assumptions of the sociocultural theory adopted here is that human modes of knowing and learning are inextricably related to the use and mastery of cultural (symbolic and physical) tools in situated activities, including the ability to understand and reason by means of these tools (Säljö 1999, p. 152; Cole 1996). In a technologically complex society, humans learn, work, and develop skills by using a range of symbolic artefacts that are intimately related to and implemented in physical tools, that is, conceptual distinctions are built into and emerge in the situated use of physical artefacts. Written language and counting systems are thus implemented and appropriated by means of calculators, word processing, and spelling programs (Grossen and Pochon 1997; Ivarsson and Säljö 2005).

Attention to the situated actions of participants within the social and linguistic context of activities is a condition and theoretical lens for a sociocultural understanding of human thinking and learning. The focus is thus on the process of appropriation, as it emerges and is observable on a microgenetic, interactional-dialogic plane. It is on the interactional-dialogical plane that social meanings are perceived and developed (Lantolf and Thorne Q1 2006; Vygotskij 1978; Werner and Kaplan 1963). The symbolic, conceptual, and technological tools, together with social interactional partners, are part and parcel of the interactional contexts that embed and guide joint meaning making, perception, and action (Rosetti-Ferreira et al. 2007).

[1] The spellchecker may diagnose both real spelling errors, and "false" misspellings, when no error has been made (for instance, when the software's pre-designed features simply do not recognize/entail a specific word).

[2] In conversational activities, correction is defined as a specific order of discursive work that refers to replacement of a "production error" or "mistake" with what is "normatively" correct (MacBeth 2004: 705; Jefferson 1987; Schegloff et al., 1977). The orientation seems to be toward the normative correctness of a correction outcome rather than toward the problem of common understanding (MacBeth 2004, p. 729). Repair is a different, prior order of discursive work that deals with participants' problems in mutual understanding and allows assurance of the recurrence of intersubjectivity in the conversation (Schegloff 1992). As demonstrated by MacBeth in his study of corrections in instructional/educational activities (2004, p. 728), correction shows its relevance only in the presence of the achievement of common understanding about the trouble source, that is, that a normatively adequate remedy for a production error (mistake) is being requested.

Computer-supported collaborative learning and interaction

The goal of CSCL tools is generally to scaffold learning as part of collaborative activities and establish learning environments with screen scaffolds that can generate communicative activities facilitating knowledge building and collaborative enquiry through participants' engagement in transformative discourse, reasoning, and argument (Stahl and Hesse 2006, p. 427; see also Arnseth and Ludvigsen 2006; Littleton and Light 1999; Mercer and Wegerif 1999). Interaction and learning are thus inextricably related: In the context of collaborative discursive practices, thinking and learning are made publicly observable and available for the mutual evaluation of participants. Divergences in understanding, skills, and/or reasoning, when acknowledged by the participants, may serve as an incentive to modify and reconfigure the modes of knowing (Jordan and Henderson 1995; Stahl and Hesse 2006). One of the basic assumptions about learning in joint activity contexts is an understanding that people acting jointly are able to co-construct contexts in which expertise emerges as a feature of a group.

However, studies concerning the effects of CSCL activities and tools demonstrate contradictory results (see Arnseth and Ludvigsen 2006 for a detailed discussion). The negative effects and disadvantages of CSCL are shown by research investigating the use and implementation of these tools in everyday educational activities.

Recently, there has been a call to widen the empirical, methodological, and theoretical approaches to CSCL, pointing out the importance of the social and cultural aspects of the setting in which CSCL tools and activities are implemented (e.g., Arnseth and Ludvigsen 2006; Crook 2002; Koschmann 2002; Stahl 2005; Säljö 2004). It has been suggested that the definition of a CSCL activity as such can be fruitfully widened beyond circumscribed tasks and applications with well-defined learning goals to include spontaneously evolving problem solving during joint technology-assisted study activities (Crook 2002). Studies conducted in educational settings have highlighted how the institutional embedding of CSCL activities configures the objectives of the activities and the expectations of the participants, shaping (constraining) students' engagement in transformative discourse. For instance, the institutional goals of the learning task (i.e., what is the expected learning result) have an impact on the quality of collaborative enquiry. Acceptable results (i.e., the students' correct knowledge or problem solution) can be achieved through "less collaborative effort" on the part of the students, and transformative discourse may be abandoned altogether (cf. Arnseth and Ludvigsen 2006; Arnseth and Säljö 2007; Light and Littleton 1999). Q3

Another important factor shaping collaborative discourse in the context of CSCL activities is a general cultural preference for consensus and social ambience in social encounters (e.g., a preference for agreement in social interaction; Pomerantz 1984). Cognitive tools for transformative discourse such as negotiations, articulation of divergent ideas, and disagreements may be avoided to preserve the atmosphere of social ambience in the group (Arnseth and Ludvigsen 2006; Dwyer and Suthers 2006).

The format and properties of the computer resource as such may influence the interactional shape and development of a collaborative discussion in distinctive ways. Crook (2002), for instance, has shown that learning materials that are "partially incomplete" effectively challenged students to engage in more participation, motivated discussion and furnished a more provocative basis for reflection as compared to exact/didactic learning instructions.

Moreover, interactional conditions facilitating learning may differ in various knowledge domains. Whereas in science learning, negotiations, hypothesis testing,

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and categorization work are the way to the appropriation of scientific concepts and constitute the goal of learning activities, in second language (L2) learning, "collaborative dialogue" may function as a socially constructed cognitive tool in two ways: It serves the construction of knowledge about language itself, and it also serves language learning by mediating its own construction (Swain 2000, p. 112). New linguistic knowledge may be appropriated through modified production of language forms, so-called "pushed collaborative output," mediated by corrective feedback and learner's self-corrections (Swain 2000, p. 111; Lantolf and Thorne 2006). In the domain of spelling, the teaching and learning of English spelling, rather than being based on the exploration of linguistic concepts and metalinguistic notions, is traditionally configured as memorization and visually based recognition of letter sequences (i.e., so-called "alphabetic layers of information" Templeton and Morris 2001).

Interaction in the context of technology-assisted activities

The centrality of discourse in CSCL motivates a closer, systematic attention to the features of verbal and nonverbal interaction in situations of use. Importantly, social interaction in technology-assisted activities is adapted, transformed, and modified by the technological context and its opportunities for participation (Dwyer and Suthers 2006; Lipponen et al. 2003). When technological artefacts become incorporated into the interactions of the people using them, the users need to attend to the demands, availabilities for action, and constraints that emerge from the design of computer system (Hutchby 2001, p. 2). The design of verbal contributions is influenced and saturated by the activity context, allowing and generating its elliptical design, indexical of the participants' shared meanings and prior understanding, and is inextricably related to the visual characteristics of the screen resources and the potentials for action that they furnish (Goodwin 2000; Linell 1998, 2009).

Research on interaction in the context of technological artefacts has demonstrated that a conversational model (as described by CA) provides a fruitful starting point for the initial exploration of meaning making in technological environments. At the same time, this research has warned about "a wholesale transposition" of conversational structures: Interaction in technology-based settings has its specificities, as compared to ordinary conversations, and is characterized by the absence of sequence-based coherence and local control, as well as by the nonverbal character of the technology's "contributions" (Greifenhagen and Watson 2009; Goodwin and Goodwin 1996; Heath et al. 1994; Hutchby 2001; Suchman 1997, 2007).

Joint work at the computer is characterized by a particular configuration of resources that constitutes opportunities for participation (Heap 1989; Lipponen et al. 2003). For instance, the material ecology and physical features of the computer (e.g., positioning of the students in relation to the screen and their access to the keyboard and mouse) provide for differential access to influencing objects on the screen. In addition, the joint nature of work usually conditions the users' joint responsibility for the outcome of the task, reconfiguring the sense of authorship of actions.

In a detailed study of a joint task with a computer, (Greifenhagen and Watson 2009) have explored the social organization of collaborative work on "visual trouble sources" defined as "production errors" (Jefferson 1987) or things that "visibly went wrong" for the participants on the screen and needed to be "replaced." They have demonstrated several significant specificities of these procedures as compared to discursive work in talk-in-interaction.

Correction in talk-in-interaction is commonly understood to refer to verbal replacement of language production errors (Jefferson 1987; Macbeth 2004). A correction sequence involves two actors, and the authorship of verbal actions (i.e., self-/other distinction) is well-defined, providing an organizing principle of this discursive structure. It comprises the speaker's verbal turn, entailing the trouble source, self- or other initiation of, and effectuation of the correction. The verbal design of the initiating turn indicates the nature of the trouble source in different ways (e.g., specific or general initiators), and has the potential of guiding the interpretation of what will count as an appropriate remedy (Koshik 2002; Schegloff et al. 1977).

In contrast, as demonstrated by (Greifenhagen and Watson 2009), collaborative computer work provides different ways of remedying a visual trouble source, and a different sense of authorship of these actions. More specifically, due to the material ecology (access to keyboard and mouse) and the joint responsibility for the task, the authorship of actions is redefined: The self-other distinction does not apply, and the development of a correction structure is reconfigured. While visual correction is finally effectuated only through the action visually manifested on the screen, the process of coming up with an adequate remedy can involve a trajectory of verbal and nonverbal actions in which both the "doer" of the trouble source and the fellow student are provided with opportunities or participation (i.e., involvement in negotiations of what can count as an appropriate replacement). Importantly, the computer contribution that visually indicates a trouble source does not, in itself, initiate a correction. It may be, however, informative as to the nature of the trouble and provide an incentive for the user's remedial actions.

In the following, drawing on work on visual trouble sources, I will explore how language production errors, visually highlighted on the screen, are resolved with the help of spelling software. In doing so, I will attend to how the technological artefacts are incorporated into the joint meaning making and interaction of the students. More specifically, the study will illuminate how the inherent conceptual distinctions, characteristic of different spelling tools, make specific actions available to students, and in different ways, configure their collaborative efforts to find and remedy the trouble source.

Method

Setting, recordings, and data

The students' spontaneously occurring spellchecker-assisted error corrections were documented as part of their authentic study activities, namely, their group work on an English-as-a-second-language (ESL) writing project. The data include video-recordings (10 h) of collaborative group writing sessions during a joint ESL writing project in a Swedish upper secondary school. The two groups of students (dyads) were video-recorded. The multiple writing sessions of each group were documented using two cameras. One camera recorded in detail the information displayed on the screen. The second camera was used to capture the students' actions (body orientation, use of various document sources, and computer facilities) around the screen. During their work, the students used Microsoft Word and its standard English spellchecker. Their assignment was to write a joint English text on a chosen subject. Institutionally, there was a preference for the construction of a linguistically correct English text, and the final product was to be evaluated by the teacher.

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Two different forms of collaboration were documented: (a) the dyads collaborating on one computer, one student using both keyboard and mouse while the other student took on the task of composing the text, orally dictating it, and monitoring the writing process visible on the screen; (b) the dyads writing different parts of the joint text on two adjacent computers. Because the correctness of the final product was of equal concern for the members of the group, collaborative spellchecker-assisted corrections were recurrent features of both types of collaboration. Even when the students were working on separate computers, spelling errors were recurrently dealt with jointly: The students readily reoriented their attention to the other's screen, asked for and received the fellow student's attention and assistance.

Unit of analysis

Software-based corrections spontaneously occurring during the joint writing sessions were transcribed and analysed in detail, focusing on the students' actions in regard to the spelling program's indication of error, that is, red underlining produced by what here is termed a *diagnostic function* of the software. Drawing on practice-related studies of "the usability of technology" in collaborative activities, the focus of the present study is on the emergent practices of users in interaction with a designed artefact (Arnseth and Ludvigsen 2006; Hutchby 2001; Säljö 2004; Zemel et al. 2008) rather than on the design features of the software per se. The unit of analysis thus comprises correction episodes, defined from the participants' perspectives (Heritage 1984), starting with the students' acknowledgement (verbal or nonverbal) of the spelling error until the correction procedure is closed down, at which point students move on to writing the subsequent portion of the text. The present analysis includes excerpts from multiple interactions. The selection is based on repeated viewings of the video-recorded correction situations, and I use these excerpts to exemplify consistent variations in the students' appropriation of technological resources for solving language production problems. The excerpts also allow me to explicate and to discuss some of significant rationalities underlying the social organization of collaboration in technology-assisted corrections.

Methodological considerations

Methodologically, the analysis adopts CA's analytical mentality and detailed attention to interactional processes, explored through participants' sense making with regard to each other's contributions. More specifically, the present work is informed by the approach to "visual trouble sources" developed in the analysis of collaborative computer-assisted work. In all, integrating microanalysis and sociocultural perspective may allow us to more fully analyse the appropriation of technological resources as socially observable meaning-making practices, and to illuminate their potentials for learning (e.g., Stahl 2005).

Transcription conventions

The students' talk and writing in English are transcribed and represented. Talk, originally produced in Swedish, and its translation to English are transcribed in italics within square brackets. In order to enhance the readability of the extracts and considering the difficulties in representing a combination of multiple modalities (writing, talk, and gazes), the participants' and software's "instructions" are described in narrative format. An inserted space is marked after a typed word and indicates a space inserted by the typing student. Capital letters indicate talk at a markedly higher amplitude.

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In this section, I will provide a short general description of the basic spelling software functions—the diagnostic feature and spelling lists—and describe the outline of the article.

When writing, the diagnostic function of the software provides continuous monitoring of the writing outcome and diagnoses "language production errors," visually displaying this feedback as a red underlining of a particular word. Such evaluative feedback is produced after a word completer, that is, an inserted space after a word. Importantly, the diagnostic red underlining is only a general, visually manifested indication of the error. It underlines the entire word, but neither specifies the spelling error (what is misspelled in the word) nor automatically proffers its remedy. A spelling list, another function of the software, can then be solicited to assist in the work on the trouble source: It generates and displays a list of words as potential error replacements. Lists can entail various lexical items and/or morphological variants of the same word.

Technology generated "responses" and "instructions" however, are not fixed in advance, rather they are inherently under-specified, and need to be interpreted, negotiated, and effectuated in the situated activities of the users (and aligned to the current context) (Arnseth and Ludvigsen 2006; Dwyer and Suthers 2006; Koschmann et al. 2006). Users of linguistic software also need to attend to the specificities of language-in-use, characterized by indexicality, multifunctionality, and context-dependence (Linell 1998, 2009). In consequence, the software-generated error indications and remedy lists are inevitably incomplete and underspecified in terms of how language production errors can be resolved and which software "solutions" need to be implemented.

This indeterminacy shaped the students' corrections in specific ways, requiring their joint engagement, interpretative attitude, and meaning making (cf. Säljö 1999). It also necessitated the achievement of common understanding, and agreement as to how to correct the error, and was inextricably related to the students' coordination and alignment of perspectives and language knowledge. One of the key factors that generated availabilities for interpretative attitude and collaborative involvement in error solutions was the general character of the visually manifested trouble source, which neither provided any clues as to what could constitute a correction outcome nor pointed out specifically the misspelling.

Whereas it could be expected that spelling lists would be deployed as a primary, easily attainable, and straightforward resource in problem solution, instead technological tools were appropriated by the students in somewhat unexpected and unpredictable ways (as compared to designer intentions; e.g., Dwyer and Suthers 2006). As will be demonstrated in the analysis bellow, the diagnostic function as such constituted an important resource in corrections, and was deployed to assist minimally in the students' attempts to come up with an adequate error solution (by themselves). The joint corrections proceeded differently depending on the technological resources employed to engage in and facilitate error correction. The conceptual (linguistic) distinctions and functions inherent in the technological resources made certain actions possible and relevant for users (e.g., Goodwin 2000; Goodwin and Goodwin 1996) and organized collaboration in specific ways.

In the following, I will present four episodes selected to illustrate the different ways in which these resources configured participants' meaning making, collaboration, and their efforts to find and remedy the trouble source. More specifically, the extracts exemplify the

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students' joint corrections based on the appropriation of diagnostic tools, and the students' deployment of spelling lists. The analysis will also attend to the microgenetic features of these situations.

Correction procedures based on the collaborative use of the software's diagnostic tools

The first example illustrates how the students correct the spelling error without soliciting a prepackaged list of solutions. Instead, they actively deploy and act upon the diagnostic function of the software (red spelling error underlining) in their efforts to work out the remedy by themselves. By using the software's diagnostic tools, the students engaged in ongoing, situated inquiries regarding the appropriateness of the visually effectuated correction. The diagnostic error markers were solicited to form an evaluative frame bracketing the students' corrections and a correct spelling was progressively worked out in a sequence of incremental remedial actions, where a number of candidate remedies were tested in rapid succession. Importantly, peer collaboration was important to overcoming the indeterminacy of the technological instructions.

The example begins with the student's individual efforts to solve the language production trouble. One of the students (Anna) is typing by herself, while Sara, the other student, is typing on the other computer (a part of their joint writing assignment), and she does not have visual access to the computer screen. In the title of the story, Anna has already written "Kodak Theathre" and the spellchecker has underlined the word "Theathre" in red. In the following, Anna is writing a new sentence that begins with the same phrase.

Ex. 1a. "Kodak theatre"

01. Anna types: "Kodak Theateher "
02. The word "Theateher " is underlined in red.
03. Sara says something that cannot be heard.
04. Anna deletes "eher" and then types "her " Anna answers Sara "*måste vi?*" ["*do we have to?*"].
05. The word "Theather " is underlined in red.
06. Anna deletes "ther"
07. "Thea" is not underlined in red.
08. Anna asks Sara "*hur stavar man* Theatre?" ["*how do you spell* Theatre?"].
09. Sara says "*T h e a t h e r*".
10. Anna types "ther "
11. The word "Theather " is underlined in red.
12. Anna asks Sara "*är det t h e a t h e r?*" ["*is it t h e a t h e r?*"].
13. Sara says "*t e r*"*?*
14. Anna deletes "ther" and types "er "
15. Anna asks Sara "*bara så?*" ["*just like this?*"].
16. The word "Theater " is underlined in red.
17. Anna deletes "ter" and types "ther "
18. The word "Theather " is underlined in red.
19. Sara says something that cannot be heard.
20. Anna says "*a men skit samma*" ["*yeah but all the same*"]
21. Sara says "*men*" ["*but*"].
22. Anna says "*a men han tycker det fel*" ["*yeah but he thinks it's wrong*"]
23. Anna types "is the most"

Anna types "theateher" and inserts a space (line 1). The spelling program underlines the word in red and highlights it as a "language production error" that is, a general trouble source. It does not, however, exactly specify the error and remedy (i.e., which part of the word is misspelled, and how it needs to be remedied). Anna immediately reacts to the red error underlining and initiates an individual attempt at correction (line 4). Instead of soliciting a spelling list, she engages in several individual attempts to work out the remedy, shaped as an incrementally progressing sequence of actions: (1) she deletes a part of the word, (2) types an alternative sequence of letters (lines 4–6), and (3) submits the current correction to the scrutiny of the spellchecker by inserting a space. The inserted space can be seen as a confirmation request, checking the appropriateness of her correction. Close attention to Anna's actions (typing and deleting) shows that her repeated attempts to correct, change, and redo the same part of the word, display her consistent orientation as to where the error is located, that is, in the second part of the word. In line 4, she deletes the final part of the word "-eher" (leaving "Theat"), which she (presumably) considers the more exact location of the error, and she remedies it by typing a new sequence of letters (adding "-her" to the initial "Theat"). In line 6, Anna tests an alternative version of the trouble source, and extends the location of error to the final "-ther".

Technological assistance, however, is not enough, and she loudly bids for peer assistance (line 8), asking Sara for a general indication of the spelling "*how do you spell* Theatre?". Subsequently (in lines 8–19), visually manifested corrective actions on the screen are responsive to Sara's verbal remedy proffers and follow a similar pattern as above: (1) locating and defining the specific trouble source (by deleting some part of the word), (2) typing a replacement (a new sequence of letters), and (3) soliciting a ratification of the correction outcome (inserting a space). The prevailing red underlining is interpreted as a correction invitation and triggers a new set of corrective actions. The diagnostic function is thus attributed linguistic expertise and authority and is treated as a "centre of coordination" of a joint activity (Suchman 1997), a basis for coordinating the collaborative correction. Although Anna is typing some of the sequences of letters that she tested earlier in lines 1–7, she is not simply repeating herself. Instead, within the social context of joint activity, her actions can be seen as her appropriation of her peer's (Sara's) linguistic expertise: Sara's instructions are novel in the sense that she did not participate in, and is not aware of, Anna's individual correction attempts.

After several unsuccessful peer-assisted correction attempts (the word is still underlined in red), Anna terminates the correction episode and rushes through the rest of the sentence (typing "is the most"). Her (anthrophomorphic) response to Sara *"he* (the computer) *thinks it's wrong"* accounts for her decision and clearly indicates that the students are working towards a solution, diagnosed as correct by the spellchecker (line 22). The diagnostic function is treated as a normative anchor of activity, and is assigned a higher degree of linguistic expertise/authority than the fellow student. This indexical account is multifunctional: Motivating the decision to dismiss Sara's instructions with reference to software authority, Anna simultaneously works to preserve the atmosphere of social ambience between the collaborating students.

Sara persists, and moves closer to gain visual access to Anna's computer screen ("Ex. 1b"). She reinitiates a correction episode by verbally specifying a potential correction outcome "*but test writing with r e maybe they usually have strange things like this*".

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Ex. 1b

01. Sara says "*fast testa att skriva med r e kanske*" ["*but test writing with r e maybe*"] pointing at the screen.
02. Sara says "*dom brukar ju ha sådant här konstigt*" ["*they usually have strange things likethis*"]
03. Anna deletes "er" in "Theather" and types "re " Sara says "*eller h r kanske*" ["*or h r maybe*"].
04. The word "Theathre " is underlined in red.
05. Sara says "*ta bort hået det andra h*" ["*delete the h the second h*"].
06. Anna deletes "hre" and types "re "
07. The red underlining from word "Theatre " disappears.
08. Anna says "*SÅ*" ["*LIKE THIS*"].
09. Anna moves the cursor to the word "Theathre" in the title and deletes the second "h"
10. The red underlining in the title "Kodak Theatre" disappears.

When pointing at the word, Sara verbally specifies the remedy "r e" and modifies it slightly "h r" (lines 1–3), and Anna complies by resuming the correction episode. She deletes "er" leaves "Theath" adds Sara's candidate "-re" and inserts a space (line 3). The word is still highlighted as a trouble source, and Sara offers another correction outcome, this time acting upon the prior correction, she specifies *what*, *where,* and *how* the word needs to be remedied, namely, "*delete the second h*" indicating that the prior correction (ending -re) is partially correct. When Anna uses the space bar as a ratification request device (line 6), the red underlining disappears. Anna's elliptical utterance *"like this"* (line 8) is multifunctional: It serves as a boundary marker that publicly closes down the current correction episode and summarizes the correct spelling. Anna's immediate correction of the word "Theathre" in the title, when she deletes the second "h" illustrates that she has appropriated the correct spelling.

As demonstrated in this temporally extended episode, the students were persistent in their attempts to work out the correct spelling by themselves, without soliciting the software spelling suggestions. The functions of the diagnostic tool (i.e., evaluation of the words as sequences of typed letters) made available action space for the students' engagement in autonomous problem solution, which required interpretative work (i.e., the identification of the specific misspelling, and production of an alternative). By repeatedly soliciting and responding to the software's contingent diagnostic evaluations of their remedial actions, the students were systematically working their way through the extended correction sequence, using this tool as a resource for assisted performance (Cole 1996) aimed at stepwise elimination of a number of spelling alternatives.

Interestingly, although Sara in Example 1b, line 1, explicitly labels their corrections as testing, the students' actions are not ad hoc in the sense that they are random. Such diagnostically assisted corrections presented a recurrent practice in the current data. A closer look at the interactional development of this correction episode shows that the diagnostic tool is employed incrementally and recursively, systematically building the foundation building ground for exploration of two potential linguistic trouble sources. From a linguistic perspective (e.g., linguistic features of corrections), within this space the students work on two specific trouble sources: noun endings ("-er" conversely "-re" both are orthographically and

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phonetically feasible English forms) and (prior) letter combination ("-t-" conversely "-th"). Both Anna and Sara correct (retype) the second part of the word and successively try out these letter sequences in combination with each other. The adequate spelling is finally worked out when a number of combinations are submitted to the diagnostics: "-hre"->"-heter"->"-ther"-> "-ter" ->"-hre"->"-re". Insofar as spelling is taught and learned as "alphabetic layers" of information formed as the left-to-right matching of letters (Templeton and Morris 2001), the diagnostic tool allows the users to engage in autonomous reproduction and recognition of words as visually manifested sequences of letters.

Noticeably, the technology was not sufficient to scaffold the individual correction efforts ("Ex. 1a"). The facilitative character of collaboration and pooling of resources is clearly demonstrated in the micro-longitudinal development of the episode, and the students' collaborative microgenesis of the correct spelling of "Theatre". Collaborative problem solution, on the level of verbal and technology-mediated interaction, allowed them to enhance the language production and generated greater expertise in the group, with the result being a language form that neither individual student could have produced on its own (Lantolf and Thorne 2006).

Coordinating the effectuation of correction

The following extract illustrates another type of correction procedure in which the trouble source is resolved without soliciting the spelling lists (largely through the students' own efforts). In this type of correction, one of the students was able to identify the solution of the spelling error early on. The analysis will discuss the coordination requirements for a smooth effectuation of correction, and demonstrate how the ecological features of a joint computer activity affect and are co-determinant of a specific trajectory of the correction.

Ex. 2. "Campion"

John controls the keyboard and the mouse. Anton sits besides him, observing the screen and reading the English paper document.

01. Anton looks at the paper and dictates "championship"
02. John types "Campion " Anton observes the screen.
03. The word "Campion " is underlined in red.
04. Anton says "CAmpion haha"
05. John deletes "Campion" and turns to look at Anton.
06. Anton looks at John and says "*HÅ!*" ["*H!*"]
07. John looks at the screen for 1 s.
08. Anton says "CHAmpion!"
09. John says "*just det!*" ["*oh yeah!*"].
10. John types "Champion "
11. The word "Champion " is not underlined in red.

Anton, looking at a text on paper written in English, dictates the word "championship" and directs his gaze to the screen (line 1). When John types part of the word "campion" and inserts a space, the spellchecker marks it red (line 2).

Assisted by the spellchecker (the red diagnostic underlining), Anton recognizes the problem early and verbally volunteers his assistance in correcting the error through several instructions, all of which are designed elliptically. Anton mockingly pronounces "campion" (line 4),

emphasizing the contrast between this exaggerated reading and his previous serious reading ("championship" line 1). He thus points out the error, but does not explicitly project the remedy: This elliptical instruction depends on his assumption and expectations with regard to John's language knowledge (i.e., knowing the written representation of sound [S] in English).

John immediately reacts to Anton's (diagnostically confirmed) correction initiation, and deletes the entire word (line 5), but his shift of gaze to Anton indicates that more assistance is needed. It triggers a second instruction, and in this case, Anton uses a different strategy and identifies the remedy: He pronounces the missing letter "H" (line 6).

The absence of corrective action on the part of John generates yet another instruction. Emphatically marking the relevant initial sound, Anton repeats the target word "CHAmpion". He incorporates the specific replacement "h" into the larger, embedding entity (the target word) and, by way of contrast with his prior instructions, specifies the location of the remedy "h".

John's exclamation "*oh yeah*" serves as a public "claim of recognition" (M. Goodwin 1980) that asserts his prior knowledge of the spelling, which he substantiates by typing "Champion". The public character of this "recognition" serves as a discursive positioning device that allows John to account for the spelling error as "not remembering" rather than a result of his ignorance and "not knowing". He also submits Anton's suggestion to the scrutiny and control of the language software, using an inserted space to authorize his fellow student's problem solution (line 10). When no red underlining appears (line 11), the students close down the correction episode.

As demonstrated in Example 2, the diagnostically indicated misspelling was resolved without invoking the spelling suggestions. Instead, the students were relying on the locally available L2 resources. However, although the more knowledgeable student was able to identify the error and its solution early on, the correction work was temporally extended. This extended character is informative in relation to the underlying rationalities and factors that co-influence the ways in which joint actions in technology-mediated correction procedures are organized. In particular, it actualizes how the distribution of L2 expertise between the fellow students and their access to computer tools affect the trajectory of collaborative correction procedures. During this type of joint work—when only one of the students had control over computer facilities (i.e., keyboard and mouse) and, thus, was able to effectuate the correction—correction practices required intricate coordination of actions, common understanding, and the alignment of the students' perspectives—including their attunement to each other's language knowledge (cf. Heap 1989; Rosetti-Ferreira et al. 2007).

In this case, Anton, the more knowledgeable student, did not have access to the computer and needed to instruct his fellow student (the "writer"), who, by virtue of his control over the computer, was attributed rights and responsibilities for effectuating the correction. Anton's instructions, designed as verbal elliptical instructions, reflected his expectations with regard to the shared knowledge (e.g., Stahl 2005) and required interpretative work (i.e., "remembering" of the correct spelling and linguistic conventions). This design, however, was not enough for immediate effectuation of correction: Due to the publicly manifested and observable difference in the students' L2 knowledge, the participants had problems in coordinating their understanding of what constituted the specific trouble source. Importantly, it is this lack of common understanding that constituted spaces for creative engagement in language production. The misalignment in understanding and L2 knowledge necessitated the classmate's continuing scaffolding in identifying, recognizing, and/or "remembering" particular sound-letter relations. The peer-generated contingent assistance served to making (written and spoken) language form noticeable and learnable, providing availabilities and potentials for the construction of knowledge about the language itself (Lantolf and Thorne 2006, p. 285; Swain 2000).

The ecological features of the joint work on the computer constitute another important aspect of the organization of collaboration in corrections. Whereas one could argue that this correction episode is characterized by virtual absence of the negotiations concerning the usability of his fellow student's instructions, and John (the writer) is merely assigned a subservient role, and a close analysis may suggest that this role is reshaped due to his access to, and deployment of, the software diagnostic tools. Generally, insofar as the software diagnostic tools are attributed linguistic expertise and authority, the writer's access to the diagnostic tool and the control function provides him with the technological resources to monitor, evaluate, and authorize the final product.[3] In the present case ("Ex. 2"), this access allows the reshaping of the (expected) asymmetrical role distribution between the students who are working together.

Soliciting remedy: spelling lists as prepackaged problem solutions

Another type of technology-assisted correction procedure involved the students' appropriation of software generated lists, designed to enhance written language accuracy. These lists served to mediate a number of possible correction outcomes as resources for solving spelling problems.

In the following example, I will discuss how the inherent conceptual (linguistic) distinctions, characteristic of spelling lists, versus the diagnostic tool made specific actions available and possible for the students to perform. More specifically, I will show how the appropriation of these resources affected the interpretative work and collaboration, and in different ways configured the students' efforts to work out the correction outcome.

Ex. 3. "Mangement"

John controls the keyboard and the mouse. Anton sits besides him, observing the screen and reading a sheet of paper about the Stanley Cup written in English.

01. Anton dictates "mangement" while looking at the paper.
02. John types "Mangement" Anton observes the screen.
03. John asks "*så?*" ["*like this?*"].
04. Anton answers "*aa*" ["*yeah*"] and looks down at his paper.
05. John inserts a space after "Mangement"
06. The word "Mangement " is underlined in red.
07. John says "*nej*" ["*no*"].
08. John solicits the spelling list (with a mouse).
09. Spelling list entails suggestions: Management Managements
10. Anton looks at the screen for 1 s. John looks at the screen.
11. Anton says "*högst upp* management" ["*at the top* management"] and points at the screen.
12. John selects "Management"
13. The red underlining disappears.

In line 1, Anton dictates a word "management" (extracted from an English text about the Stanley Cup), but pronounces the word incorrectly [mangement]. John, accordingly, types

[3] This feature is characteristic of corrections made with spelling software and differs significantly from classroom corrections (MacBeth 2004), where only one participant, namely the teacher, has the sequential possibility to authorize an adequate correction.

"mangement" and solicits Anton's ratification (try-marking "*like this?*", line 3). Although Anton scrutinizes the word on the screen, he is not able to identify the spelling error (line 4) and closes down the correction sequence, indicating his readiness to re-uptake the dictation.

However, when John loudly inserts a space (line 5), the spellchecker highlights the gloss as a trouble source, detecting a production error that was about to be passed without notice (line 6). Now, when the spellchecker and the fellow student diverge in their instructions, John aligns with the spelling program's indication and publicly disagrees with Anton (line 7).

The next step in the correction procedure involves determining what will count as an appropriate remedy. The general underlining of the trouble source is succeeded by another type of action, as compared with Examples 1a, b, and Example 2. Instead of engaging in diagnostic software assisted corrections (cf. "Ex. 1a, b; Ex. 2"), John immediately solicits the software's spelling suggestions (by clicking the right mouse button), and the software generates a short list (morphological variants "management" and "managements"; lines 8–9). Interestingly, John solicits such a prepackaged list of possible solutions when the linguistic expertise of his fellow student is exhausted.

Anton's reading and his suggestion "Management" from the spelling list (line 11) are confirmed by John, who immediately selects this item. The red underlining automatically disappears and the students terminate the correction episode (line 13). Noticeably, the spelling alternatives, visually represented on the screen, allow Anton to improve his language production in two respects: Although Anton initially did not recognize the spelling error (line 4), he is able to choose the correct word form from the list (line 11). In addition, guided by visual inscription "Management", he corrects his pronunciation error (cf. "mangement" in line 1), demonstrating yet another case of the microgenesis of linguistic features, achieved in the context of a joint computer-based activity.

Example 3 shows that the appropriation of spelling lists configures the students' actions in different ways as compared to the episodes when the students rely exclusively on the diagnostic tools. The difference in students' correction procedures can be related to the functions and conceptual (linguistic) distinctions that are inherent in these technological mediating tools and available to users.[4] More specifically, the students engaged in different actions with regard to how the correction outcome was identified and how it was effectuated. In that the function of the diagnostic tools is limited to the evaluation of words (shaped as sequences of letters), it allowed the students to engage in autonomous attempts to produce a specific error replacement (i.e., to type a potentially correct sequence of letters), and this operation necessitated the students' own attempts to identify the error (what is misspelled) and how the misspelled feature needs to be corrected. The spelling list, conversely, displays and suggests a visually available list of words as candidate replacements, affording and constraining the range of possibilities within the actual context of the text being produced. It does not, however, require active production (writing) of the error replacement by the students, rather, the students can attend to the error implicitly, when choosing a suitable replacement from the list.

Another recurrent feature—related to the different degrees of explicitness of the digital resources (as demonstrated in "Ex. 1a, 1b, Ex. 3")—was that these resources were recurrently deployed in a progressive fashion. At first, the students—starting from individual attempts with the diagnostic function—bid for peer assistance ("Ex. 1a, 1b,

[4] Digital software resources (diagnostic tools and spelling lists) in different ways conceptualise words as linguistic elements, providing for interpretative engagement in different aspects of language production: basic phonologic (and morphologic) analysis (largely designed as the sound—letter analysis (Ex. 1a, b; Ex. 2) as compared to the selection of lexical and morphological alternatives (Ex. 3).

Ex. 2"), for diagnostic function, and finally, for soliciting the spelling suggestions ("Ex. 3"). Notably, the students' choices to rely on the different spelling tools may be informative in relation to what types of assistance they consider that they need within the social context of joint work. Insofar as the primary reliance on diagnostic tool allows for minimally assisted solutions to the spelling errors (and less explicit guidance and intervention from spelling tools), it suggests that, initially, the students assume and, in successful cases, are able to utilize the abilities and skills of the dyad. The timing of John's choice to employ the spelling remedy list in Example 3 indicates that more explicit assistance (the spelling list as a tutor) is needed when both students have exhausted their L2 expertise.

Overriding the software's indication of language error

Whereas earlier examples ("Ex. 1a, 1b, Ex. 3") show that spelling software resources (e.g., diagnostic underlinings, spelling lists) are appropriated as authoritative anchors of collaborative corrections, the present extract ("Ex. 4") is illustrative of cases in which the legitimacy and correctness of the error indication was subjected to the students' scrutiny and decision making. More specifically, the students override the spellchecker's highlighting of the error, and mock the software's list of spelling suggestions. It will be shown that the decision to override the software's authority is necessitated by, and necessitates, the students' publicly manifested discursive displays, accounts of their L2 knowledge as well as their collaborative exploration of various linguistic dimensions.

Ex. 4. "Vaesteros"

John and Anton work on separate computers where they write parts of their joint text about the NHL. John is writing a sentence about a Swedish NHL player born in the Swedish town Västerås. He types "Vesteros".

01. John types "Vesteros "
02. The word "Vesteros " is underlined in red.
03. John asks "*hur ska jag skriva*" ["*how should I write it?*"].
04. John inserts "a" and blackens "ae" in "Vesteros"
05. John says "*så!*" ["*like this!*"].
06. The word "Vaesteros" is still underlined in red.
07. John says "*såhär kan man skriva*" ["*one can write like this*"], points at the screen and looks at Anton.
08. Anton says "*a men skriv med RIktig ä*" ["*yeah but write with the USual ä*"].
09. John says "*a men det är på ENgelska*" ["*yeah but it's in English*"].
10. Anton says "*ah. och*?" ["*yeah so what?"*].
11. John deletes "ae" in "Vaesteros" and replaces it with "ä".
12. John deletes "o" in "Västeros" and replaces it with "å".
13. The word "Västerås" is still underlined in red.
14. John solicits the spelling list.
15. Spelling list entails suggestions "Vaster as" "Vast eras"
16. Anton, looking at the screen, says "WAster os" with exaggerated American pronunciation

01. (sports commentator voice).

17. John says "vaster as" with exaggerated American pronunciation.
18. John chooses "ignore" on the spelling list.

19. The word "Västerås" is no longer underlined in red.
20. Anton laughs and says "vast eras" with exaggerated American pronunciation.
21. John inserts a space and types "in sweden".
22. Spelling control self-corrects to "Sweden"
23. Anton says with exaggerated American sports commentator voice "*alltså du uttalar ju*"
24. *typ* WEsteros from NORrköping" ["*you know one pronounces it like* WEsteros from NORrköping"].

John encounters a problem concerning how to write the name of a Swedish town "Västerås" in English, more specifically, how to represent the Swedish letters "ä" and "å", line 1. When he types "Vesteros", a simplified spelling, and uses letters from the English alphabet, the software generates a red underlining (line 1). Initially, John attempts to work out the solution by himself (adding "e" to indicate a phonologically close combination "ae"). Although the spellchecker still highlights the word as a trouble source (line 6), John ignores this indication (for the time being) and issues a bid for the fellow student's confirmation (line 7). John employs a range of verbal and visual actions that solicit and guide his peer's attention (lines 4–7). Together with pointing and the verbal question "one can write like this?" he clearly prearranges the prospective area of the recipient's gaze and makes the trouble source immediately publicly visible.

Anton's instruction "*write with the usual ä*" projects a specific correction outcome and is instantly contradicted by John, who points out the discrepancy from English orthographical conventions (line 9). After several oppositional moves, John finally complies with and effectuates Anton's correction proffer: He deletes his own suggestions "ae" and "o" in "Vaesteros" and replaces them with Swedish letters "ä" and "å" ("Västerås" lines 11–12).

Noticeably, the word is still highlighted as a trouble source, and John solicits a list of spelling suggestions, overriding Anton's instruction. However, the list entails suggestions that are markedly distant from the target word ("vaster as" and "vast eras", line 15). Anton's unsolicited reading from the screen "Waster os", with a thick American accent, not only serves to mock and reject the spelling list, but simultaneously, by drawing attention to its non-usability, Anton is able display his L2 expertise (line 16). John's exaggerated Americanized pronunciation of "vaster as" (line 17) confirms and aligns with Anton's criticism, allowing the students to build an alliance and a concerted dismissal of the software's linguistic authority.

As demonstrated in Example 4, this correction sequence involved the use of a full array of language scaffolds: the spellchecker's diagnostic function, peer assistance, and spelling suggestions. In line with prior extracts, there is a similar progression in how and which digital resources were incorporated into the students' collaborative corrections (cf. "Ex. 1, 2, 3"). Q4
While acting upon the diagnostic error underlining, John starts out with his own (individual) efforts to solve the language production problem. When these appear to be unsuccessful, he solicits his fellow student's expertise, and only when this source seems to have been exhausted (i.e., Anton's instruction is not approved by the diagnostic tool), does John begin looking at the spelling software's generated problem solutions (i.e., spelling list).

The students' decision concerning whether the diagnostic marker and the spelling list were right or wrong was made by partially relying on the possibilities and constraints for action provided by the drop-down menu: Namely, the list of possible candidates was rather reduced and hardly matched the trouble source. Importantly, the students did not simply disregard the spelling suggestions. Instead, due to the expertise and authority attributed to the spelling software, the students needed to account for each other and to justify their choice to override and dismiss the spelling list. This led to their exploring the spelling list

suggestions, which were framed as entertaining language play, performed in an American (NHL) sports commentator voice (lines 16, 17, 20, 23–25). The discursive work, aimed at accounting for their dismissal of the spelling list, generated and provided for verbal language production that extended beyond the traditionally used institutional student-teacher talk register. Moreover, Anton's metalingual comment "*you know one pronounces it like this* Wästerås from Norrköping" was designed as a teaching instruction: Within a novel and syntactically elaborated target language construction, it presented and exemplified an Americanized pronunciation of the Swedish town name.

Concluding discussion

By focusing on the immediate social and material ecologies of the collaborative learning activity at the computer, the present study examined how language software, more specifically various features of a spellchecker, was deployed and acted upon during the students' joint spelling error corrections. Drawing on the sociocultural theory of learning and ethno-methodological (Conversation Analytic) insights into social interaction, I have focused on students' meaning-making practices and explored the functions and purposes that computer applications acquire in everyday activities in educational settings. More specifically, by investigating collaborative corrections of language production errors, highlighted on the screen as visual trouble sources, the present study has shown how the inherent conceptual distinctions, characteristic of different spelling tools, made specific actions available to students, and configured their collaborative efforts to find and remedy the trouble source in different ways.

Institutional framing, indeterminacy of spelling tools, and spontaneous joint problem solving

As demonstrated in the present study, spontaneously occurring technology-assisted error corrections constituted a complex situation, where a number of socioculturally significant factors shaped joint work trajectories. The institutional embedding of the assignment and the goals/objectives of the task, the properties and characteristics of the spelling tools, group dynamics, and the material ecology of technological resources (i.e., access to and control over technological resources) were all inextricably related when configuring the correction procedures. The visual character of corrective actions, effectuated and available on the screen, generated publicly available ground for action (partly accounting for the elliptical and projective design of the students' verbal instructions).

The students' collaborative involvement in corrections was responsive to the institutional definition and framing of the task in the sense that the students were accountable for a specific assignment outcome, that is, a joint, linguistically accurate text. In the context of joint work, the incompleteness and indeterminacy of the spelling program's "instructions" and "responses", and the general diagnostic error marker in particular, motivated the students' collaboration, decision making, and the interpretative work that was needed to reach a mutually agreed upon correction outcome. Overall, while the spelling program was saying "enough" to let the students know that something was wrong, the fact that it did not say "too much" left space for the students to demonstrate that they were able to find an adequate remedy (cf. Greiffenhagen 2008). This indeterminacy, together with the indexicality and context-dependence of language-in-use, provided the collaborative creative space necessary to evolve a shared perspective: namely, some sort of jointly endorsed solution regarding the spelling error (cf. Crook 2002).

Different software tools and the configuration of joint corrections

Collaborative correction procedures were inextricably related to and shaped by the students' ongoing, contingent orientation toward the spelling software's functions in situ, rather than what could be pre-designed and expected uses of the spellchecker's resources. Different tools allowed for and configured different paths for working out the remedy. The students did not confine themselves to the (immediate) deployment of spelling lists, but recurrently relied on the diagnostic tool and peer expertise instead. The inherent conceptual (linguistic) distinctions, characteristic of various software resources, made specific actions available to and possible for the students, and configured their collaborative efforts to find the remedy in different ways.

As demonstrated in Examples 1a, b-2, when acting upon a visual error indication (a general trouble source), the students attempted to find an adequate solution by themselves, and used diagnostic features of the linguistic software as an authoritative resource for scaffolding their actions toward the "adequate" error correction. Correction procedures were shaped as a multipartite routine-like sequence of incrementally organized actions that included: 1) an identification of the specific trouble source/error, 2) an effectuation of the correction, 3) a subsequent confirmation check/evaluation. The students thus acted upon this resource as a "centre of coordination" and a normative anchor of their joint correction activity (Suchman 1997). The diagnostic function of the software was employed in a recursive way, both checking the appropriateness of the previous corrective action and projecting the need for a new, revised version of the correction.

The functions of the diagnostic tool—that is, evaluation of words as sequences of typed letters—created available action space for the students' engagement in minimally assisted problem solving. More specifically, it allowed involvement in a (partially) autonomous production—typing—of the remedy. Such corrections required the students' involvement in: 1) the identification of a specific misspelling, and 2) self-production of a revised word. In contrast, remedying the error with a software-generated list of words ("prepackaged" suggestions as to a potential solution to the spelling problem) did not require the students' own production of the error replacement, rather, the students could attend to the error (a specific misspelling) implicitly, when choosing a suitable replacement from the list.[5]

Different software resources were thus attributed different degrees of explicitness (and intervention), and were recurrently deployed in a progressive fashion, shaping the collaborative procedures in distinctive ways. Peer assistance accompanied by diagnostic evaluation was solicited prior to spelling suggestions ("Ex. 1a, b, 2, 3, 4"). Notably, this progression, and more particularly the timing of when spelling lists were deployed (i.e., when other locally available resources, and more specifically, the peer's expertise were exhausted, "Ex. 3; 4"), suggests that the students in the present study initially attempted to rely on the skills and abilities of the dyad, preferring minimally technologically assisted spelling error solutions and less explicit guidance and intervention from the software.

[5] Although there is much to be understood about the kind of assistance and support these software resources can furnish, it may be tentatively suggested that the students relying on the diagnostic tool were executing a different kind of participation in terms of their interpretative work with regard to the error and its replacement. Starting from studies on learning demonstrating that actively generated information is remembered better than presented information (see Crook 2002 for an overview), the students' autonomous involvement in the production of a remedy with only minimal assistance from diagnostic tools may constitute such a constructive condition.

Physical access to and control over computer applications, and the design of joint corrections

The material ecology of computer work, and more specifically, limited physical access to and control over technological resources (mouse and keyboard) were significant in the shaping of joint corrections and group dynamics in particular. In that the linguistic software resources were attributed authority and acted upon as sources of linguistic expertise, the student, who had physical access to the computer facilities, thereby had control over technology-implemented authoritative forms of knowledge, and was able to exercise evaluative functions with regard to the group's work. Access to the software in such a way was part and parcel of the shaping of group dynamics and collaboration: The authority attributed to the digital resources provided incentive for the students' accounts and displays of their L2 expertise (for instance, when justifying the choice to disregard software instructions, as shown in "Ex. 4").

Division of labour had another significant effect on the organization of corrections. In that the effectuation of correction (e.g., typing) was the prerogative, right, and responsibility of the student with access to the computer facilities (mouse and keyboard), collaborative correction required neat coordination of joint actions and L2 knowledge, creating situations in which divergences in the collaborating students' knowledge could be revealed, acknowledged, and resolved (e.g., through instructive exchanges, see "Ex. 2").

Joint technology-assisted corrections as potential sites for learning

On the whole, peer collaboration allowed students to overcome the indeterminacy of the technological "contributions" and "instructions". The appropriation of spelling software in the social context of a joint classroom assignment can be seen to provide a space for creative collaborative engagement, allowing students to build on their (prior) knowledge, to expand their language repertoires, and to pool their resources, the result being more than any of the individuals could have produced on their own. Insofar as the sociocultural perspective conceptualizes (language) learning as a gradual and cumulative, socially embedded process of assisted performance, coordination, and adjustments, collaborative software-assisted corrections can be seen as an activity context that may provide the conditions for microgenetic development of skills (cf. Lantolf and Thorne 2006; Rosetti-Ferreira 2007). Importantly, however, the mastery of such technological tools needs to be discussed and related to the students' being and becoming aware of the limitations and constraints of the software. In order to avoid too passive a relationship to and attitude toward the technological tools, or what could be termed as "deference to resources", pedagogical intervention aimed at enhancing a critical attitude toward the forms of authoritative knowledge that software tools manifest, may be necessary (Crook 2002; Säljö 2004).

Concluding comments

In all, by adopting a practice-oriented approach to joint computer-assisted activities, the present study has identified and highlighted the local rationalities guiding the students' involvement in spelling error corrections, demonstrating the cultural meanings and purposes that technological artefacts acquire as they are implemented and appropriated in the institutionally embedded activities of the users.

Overall, the use of a spellchecker and of technology-assisted monitoring of language production is a recent practice, nevertheless widely adopted by the users (e.g., Grossen and Pochon 1997). Noticeably, when human knowledge is given a distinct material shape and is configured through novel inscriptions and representations (implemented in widespread technological tools), such resources have the potential to serve as active elements in the cognitive socialization of users (Cole 1996; Ivarsson and Säljö 2005). Detailed analysis of the participants' meaning making and actions in the everyday situations of use may illuminate some of the ways in which implementation of these technological resources may contribute to the (re)configuration of human modes of knowing and learning.

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