

PROCESSES AND OUTCOMES IN NETWORKED CLASSROOM INTERACTION: DEFINING THE RESEARCH AGENDA FOR L2 COMPUTER-ASSISTED CLASSROOM DISCUSSION

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ABSTRACT

The present paper focuses on the use of one networked technology, namely synchronous computer-mediated interaction, in the second language (L2) classroom. The scope is intentionally limited to research concerned with evaluating the potential benefits of computer-assisted classroom discussion (CACD) in terms of second language acquisition (SLA) theory. The findings stemming from the existing body of L2 research on CACD are critically examined and a number of methodological suggestions are offered for future research on CACD. It is suggested that in addition to analyzing language outcomes by means of well-motivated measures of L2 use and L2 acquisition, a multiplicity of data sources be used in CACD research, so as to be able to document the processes learners actually engage in when interpreting and carrying out CACD tasks. A process- and task-driven research agenda for L2 CACD is proposed with the ultimate goal of describing the nature of language, learning, and interaction fostered in networked synchronous communication and to ascertain which features of CACD may or may not be relevant to the processes involved in second language acquisition.

NETWORKED CLASSROOM INTERACTION AND SECOND LANGUAGE LEARNING

From drill-and-practice software, to word-processing programs, to network and hypertext software, the gradual integration of technology in classrooms over the last twenty years has tended to mirror the technological developments and limitations of each computer era as well as, more importantly, the theories of learning and instruction developed by scholars and construed in teachers' actual practices. Thus, the introduction of networked technologies in education coincided with a shift in education from an interest in cognitive and developmental theories of learning to a social and collaborative view of learning (cf. Hawisher, 1994).

Since the early 1990s, national and international networks, on the one hand, and local area networks (LANs), on the other, have been widely used for instructional purposes within social and critical education approaches. The use of electronic mail, bulletin boards, or discussion lists on worldwide networks such as the Internet enables learners and teachers to access and share information in a time- and space- independent fashion. By contrast, the instructional use of LANs, which link computers in a laboratory or a classroom to each other, has introduced the possibility of real-time, synchronous, many-to-many written discussion by a whole class or by smaller groups within the class (Warschauer, 1996b). Both technologies underscore a view of learning as a collaborative act that happens in a social and political context, with learners and teacher working together in the new medium of networked interaction.

Some scholars have suggested that the era of hypertext and networked communication that started burgeoning in the mid-1990s signals the need for an expanded view of literacy: Computers can no longer be seen as a surrogate of the teacher or an intelligent tool in the hands of the student, but as a new medium that has changed the ways in which we write, read, and possibly think (Selfe, 1989). Without committing to such a radical analysis of the role of technology on literacy practices, I would agree with Herring (1996), Selfe and Hilligoss (1994), and others that we need research on computers and education that not only extols the pedagogical and social virtues of computer technology but also determines exactly

in which ways language, learning, and interaction have been transformed by the use of networked and hypertext technologies in our classrooms. In the case of L2 classrooms in which CACD has started to be used, the crucial question from an SLA perspective is in what specific ways CACD may or may not be relevant to the processes involved in second language learning.

Computer-Mediated Discussion in the Language Classroom

The use of networked computers for the purpose of large group discussions in language educational contexts began with hearing impaired students learning L1 composition at Gallaudet University (Batson, 1988). The software application for computer-assisted classroom discussion (CACD) which is most widely used in foreign language classrooms is the Daedalus Integrated Writing Environment (Daedalus Inc., 1989) and its application InterChange. This software was developed in the 1980s in the English Department at the University of Texas at Austin by Fred Kemp, a scholar in composition studies, and colleagues. Social theories of writing instruction that emphasize the collaborative nature of meaning and writing were at the core of the Daedalus software as it was intended to be used in composition classes (see Barker & Kemp, 1990; and for a discussion of the concomitant social epistemic theory of writing, see Berlin, 1987). In foreign language classes, Daedalus began to be used also in the University of Texas at Austin in the early 1990s, but the orientation was more on target-language practice than on the development of writing skills. In the last six years, a small number of FL studies (and most recently ESL studies) have reported on the use of InterChange/Daedalus in CACD in various FL classes in universities in the United States, typically for general classroom discussion purposes rather than in connection with L2 writing instruction.

How does CACD work? During a typical Daedalus/InterChange session in the computer lab, each student sits in front of a computer terminal and is free to type in messages that can be sent by clicking on the "send" button on the screen. Sent messages appear on the upper half of all individual screens, displayed in the order in which they were sent and automatically identified with the name of the sender. All class members can read each other's comments at their own pace by scrolling up and down the sent-messages window, and they can write messages at their own leisure without interfering effects (freezing, etc.) from incoming messages.

Among the many different types of CALL activities available for second language instruction, CACD stands as a promising area for research in second language learning and teaching for several reasons. For one, conducting class discussions on a computer network entails meaningful use of the target language and forces teachers and students away from treating language as an object rather than as a medium of communication (e.g., Colomb & Simutis, 1996). Not only is CACD a communicative CALL activity in Underwood's (1984) sense, but it can promote a task- and interaction-driven approach to L2 learning and teaching which is the backdrop to concrete proposals for curriculum design superseding traditional communicative approaches (e.g., analytic and Type B syllabi as outlined in Wilkins, 1976, and White, 1988, respectively; see also detailed discussion of procedural, process, and task syllabi in Long & Crookes, 1993). The communicative investment and the meaningfulness and relevance achieved in many CACD discussions appear to provide for a context in which opportunities for language development are enhanced, since students are motivated to stretch their linguistic resources in order to meet the demands of real communication in a social context. In brief, the CACD environment appears to be optimal for devising CALL activities that facilitate and promote comprehensible output (Swain, 1985) within a holistic, process- and task-oriented approach to the L2 curriculum (Long & Crookes, 1993). Other benefits of CACD associated with language learning that have been repeatedly singled out in the FL literature are:

- Learners are able to contribute as much as they want at their own pace and leisure; consequently, they tend to perceive CACD as less threatening and inhibiting than oral interactions and produce a high amount of writing, with all students participating to a high degree and all producing several turns/messages per session.
- Because of the interactive nature of the writing, learners are expected to engage in a variety of interactive moves on the computer and to take control of managing the discussion.
- Learners make use of the available opportunity to take time to plan their messages and edit them. In this way they engage in productive L2 strategies and processes.

- Learners have exposure to a substantial amount of comprehensible input which is produced by peers of a similar level and shared background.
- Learners get a considerable amount of reading practice in addition to writing practice. Because of at least two tasks (writing and reading) competing for the learner's investment, reading skills practiced may tend to be holistic (reading for the gist) and meaning-driven. In addition, learners are expected to be motivated to read because of an authentic sense of interactive audience provided by CACD.

These putative advantages of CACD have been anecdotally illustrated in the FL pedagogical literature (e.g., Chavez, 1997; Cononelos & Oliva, 1993; Nicholas & Toporski, 1993; Oliva & Pollastrani, 1995). Impressionistic documentations of the first attempts at using CACD in the L2 classroom (e.g., Beauvois, 1992, and Kelm, 1992) have opened the way to a small body of more recent research that suggests computer-mediated synchronous discussion affords a novel medium for L2 interaction that is perhaps inherently competence-expanding (Chun, 1994; Kern, 1995; Warschauer, 1996a).

From a more general pedagogic viewpoint, certain features of CACD can also have a great impact on subverting the traditional roles enacted by teachers and students in classrooms. This may foster critical changes in well-established pedagogical practices (e.g., Cooper & Selfe, 1990; Cummins & Sayers, 1990; Warschauer, 1996b) which may also affect the amount and quality of the language used and, hence, of the learning processes in the L2 classroom (Kern, 1995). However, more and more voices in the education and technology literature are acknowledging that it is not computers per se that can be beneficial or harmful, but the use we put them to (Barton, 1994). Indeed, the newest technologies can be made to serve the most traditional pedagogies, and the philosophies of language teachers can shape the uses of technology within the language curriculum so as to preserve a rather behavioristic view of language learning, as Warschauer (1997) has recently documented.

CACD IN THE L2 CLASSROOM: WHAT DO WE KNOW SO FAR?

Three areas of electronic synchronous communication have been the focus of most CACD research to date: (a) CACD has an equalizing effect on participation; (b) it increases learner productivity in terms of overall amount of language and/or ideas produced; and (c) the language produced in electronic synchronous discussions can be expected to be more complex and formal than in face-to-face discussions, without losing the interactive nature of oral language. These three dimensions of CACD are the object of much anecdotal discussion and enthusiastic advocacy in the FL literature. However, empirical evidence in support of these characterizations of CACD needs to be drawn from a sound theoretical motivation within our field (see Doughty, 1987, for an early call on this area, and Chapelle, 1996): I would like to argue here that the benefits of CACD in the L2 classroom need to be evaluated not only from a pedagogical standpoint but also in light of our most current knowledge about how languages are learned. This can be done by examining how second language performance and, tentatively, second language learning are shaped by particular features of synchronous electronic discussion as a new environment for L2 interaction.

CACD as an Equalizer of Participation Structures

Accounts of the use of CACD in L1 and L2 classrooms identify equality of participation as one of the most pervasive and beneficial effects of using electronic synchronous discussion in L1 writing instruction (Hartman, Neuwirth, Kiesler, Sproull, Cochran, Plamquist, & Zubrow, 1991), FL instruction (Beauvois, 1992; Kelm, 1992; Kern, 1995), and ESL instruction (Sullivan & Pratt, 1996; Warschauer, 1996a).

The more equal participation pattern in electronic discussions may be attributed partly to the reduction of static and dynamic social context cues in computer-mediated communication (Hartman et al., 1991; Warschauer, 1996b), and partly to the absence of oral interaction constraints such as fear to interrupt or of being interrupted, need to manage the floor and the transfer of speakership, and need for interlocutors to co-orient to the production of sequentially relevant discourse (e.g., Schenkein, 1978). Additionally, in L2 CACD learners need not be concerned with pronunciation issues, which often require a high degree of attention and monitoring in the oral mode and may inhibit efforts at oral communication in the target language. The consequences are: (a) interactants are less apprehensive about being evaluated by interlocutors, and thus more willing to participate at their leisure; and (b) they are less affected by wait time, turn-taking, and other elements of traditional interaction, enabling them to participate as much as they want, whenever they want, with opportunities for contribution being more equally distributed among participants.

The effect of this equalizing power of synchronous electronic discussion is threefold. First, the traditional figure of the teacher as authority source and expert is subverted in that the role of the teacher during the electronic discussion is that of a mere participant (see Kern, 1995, and Warschauer, 1997). Hence, the teacher cannot dominate the floor and do most of the talking, and he or she cannot direct and redirect the development of the topic, pose display questions, nominate students as next speakers, or evaluate individual student's contributions, all of which is the norm in traditional teacher-fronted L1 and L2 classrooms (e.g., Cazden, 1988; Chaudron, 1988; McHoul, 1978; Sinclair & Coulthard, 1975). Second, and as a result of this change in teacher role, control of and responsibility for the electronic discussion is arguably incumbent on the students who are afforded the opportunity to engage in self-generated, personally relevant communication involving a wide range of moves, functions, and meanings that may be facilitative in the development of communicative competence and overall language proficiency (Chun, 1994).

Third, all speakers share the floor more equally, and students that do not normally participate much in traditional classroom discussion seem to dramatically increase their participation in the electronic mode. Naturally, a more democratic and equitable participation in electronic discussions can in turn foster counterhegemonic pedagogies (Cooper & Selfe, 1990; Cummins & Sayers, 1990; but see Barton, 1994, Olson, 1987, and Warschauer, 1997, for caveats). This last aspect of the equalizing effect of electronic discussions has been the focus of many studies in L1 education literature, which present consistent evidence of increased participation on the part of so-called poorer performing students (Hartman et al., 1991), female students (Flores, 1990; Selfe, 1990), and shyer students (Bump, 1990).

In the FL literature, the small body of studies concerned with CACD seems to provide support for an equalizing effect of electronic discussion on participation patterns. Kern (1995) conducted a within-groups quasi-experimental comparison of both a traditional whole-class discussion and an electronic discussion in two intact French classes, concluding that electronic discussion effects a radical change in the proportion of teacher versus student language production and that teacher discourse becomes less authoritative and less dominant. Chun (1994) undertook a descriptive study of the language produced in regular CACD sessions in a German class over a two semester period. She provides information concerning the ratio of teacher-output versus student-output, the proportion of student-initiated and

teacher-initiated messages, and the directionality of contributions produced in electronic synchronous discussions. Chun's descriptive approach is important in that she not only substantiates in her analysis an increase in learner production coupled with a decrease in teacher-centered discourse, but she also identifies concrete advantages of more democratic and equitable participation in terms of potential learner development in discursal, interactional, and functional competence.

In their impressionistic accounts of electronic synchronous discussions involving Portuguese and French learners, Beauvois (1992) and Kelm (1992) report increases in the participation pattern of shy students and low-motivated, unsuccessful language learners, whereby the same students were perceived by their instructors as less willing to participate in oral discussions led by the teacher. Most of the cited studies also elicited information on students' impressions and evaluations of CACD and found that students themselves identified an increase in participation (and production) as one of the benefits of engaging in electronic discussions in the target language.

Although these studies provide some useful descriptive information, a methodological and conceptual problem within their comparisons obscures the interpretation of the findings.

Namely, evidence of an equalizing effect in participation seems to be sought solely by focusing on comparisons between traditional teacher-led classroom discussions and whole-class electronic discussions, whether the comparison is experimental (Kern, 1995) or assumed as a frame of reference (Beauvois, 1992; Chun, 1994; Kelm, 1992). However, it is justified to hypothesize that group size and equality of participation are negatively related in traditional oral interactions and positively related in computer-assisted interactions, and that the benefits of electronic over non-electronic interactions will increase with the size of groups (Gallupe, Bastianutti, & Cooper, 1991). In other words, the positive equalizing effect of the electronic mode will be accentuated when comparing larger groups, as in comparisons of teacher-fronted, whole-class discussion with whole-class electronic discussion.

On the other hand, face-to-face discussions in communicative L2 classrooms are often conducted in small groups rather than as a whole class. Thus, in addition to whole-class comparisons, a more informative approach to investigating the equalizing effects of CACD in L2 classrooms would be to compare electronic versus non-electronic small group interactions of equal size, and to compare the relative effects in participation patterns when group size is equally reduced or increased in both modes. Two studies of electronic-assisted communication in ESL classes (Sullivan & Pratt, 1996; Warschauer, 1996a) are the only ones to date that have adopted such an approach and included comparisons of small group interactions in the oral and electronic modes. Both studies provide further evidence of a clear change in participation structures and a substantial increase in the amount of participation afforded to individuals in electronic classroom discussions.

Sullivan and Pratt (1996) studied both whole-class discussions and four-member group interactions in two ESL writing classes: one traditional (oral) class and one class that used the software InterChange, both of which were taught by the same teacher over the course of a semester. In the large-group-discussion comparison between groups, as in previous FL studies, Sullivan and Pratt focused on the proportion of teacher "talk" and student language production and confirmed the radical change in student/teacher participation structures in CACD already documented in the literature. Of particular interest, however, is the between-groups comparison of electronic and non-electronic peer response in four-member groups. Sullivan and Pratt's analysis of the quality of interactions here suggests that face-to-face oral discussions were dominated by the author of the essay discussed, whereas there was no one individual dominating the floor in the same type of discussions on the computer. As a result, the researchers claim, the quality and efficacy of peer suggestions for revision increased in the electronic mode.

Warschauer (1996a) undertook a within-groups, counterbalanced comparison of open-ended discussions in face-to-face and electronic discussions by four small groups of four students each. He calculated the ratio of total words produced by speaker per total amount of words produced by the group and concluded that three out of the four groups showed greater equality of participation in the electronic discussion. More research is needed that compares participation patterns of face-to-face versus electronic small group discussions, carefully controlling group format as well as other task features so as to increase the validity of the experimental comparisons.

CACD Increases in Language Output and Learner Productivity

In close parallel to changes in teacher/learner participation patterns and equitable sharing of the floor among individual participants, another possible advantage of electronic synchronous discussions is an increase in the amount of participation per individual, that is, an increase in learner productivity. In the L1 literature on electronic interaction, productivity of ideas (e.g., Gallupe, Bastianutti, & Cooper, 1991) and provision of practice (e.g., DiMatteo, 1990, 1991) have been general concerns, especially in relation to uses of synchronous electronic discussion for the teaching of composition. More specifically, collaborative and process-oriented approaches to writing point at the interest of discerning whether electronic discussions are an efficient way of increasing the volume of new ideas generated collaboratively by participants and the number of suggestions for revision and edition produced by peers (see Hartman et al., 1991; Sullivan & Pratt, 1996).

Quantity of linguistic production (rather than quantity and quality of ideas) has been of central interest in the FL literature on CACD because of the immediate implications for L2 learning in relation to SLA theory. Under a skills-based view of language acquisition, in addition to exposure to relevant input and implicit or explicit presentation of language points, productive practice in the target language is posited to be a facilitative if not necessary condition for L2 development (e.g., Ellis, 1980). A more precise formulation of this position is Swain's (1985) comprehensible output hypothesis, that predicts a crucial role for language production in L2 development on the grounds that meaningful use of a learner's linguistic resources "pushes" interlanguage development by forcing the learner to map function-to-form and meaning-to-form relationships in light of particular contexts of language use. The tentative finding that can be gleaned from the literature is that CACD may provide for an instructional context that generates opportunities for (communicative) practice of the target language and opportunities for (meaningful) learner output to a significantly greater degree than more traditional arrangements in the L2 classroom.

Kern (1995) found that students had from two- to three-and-a-half times more turns and produced two to four times more sentences and more words in the InterChange discussion than in the oral discussion. He used several rough measures of language productivity (length of learner output in terms of number of words, sentences, and turns) that are difficult to interpret because of the lack of controlled comparisons with face-to-face language production under equivalent conditions (such as number of participants, plus or minus teacher participation, etc.). Comparisons of total learner language production in the electronic and non-electronic mode are not reported in Warschauer (1996a). The remaining studies provide indirect support for an increase in learner language production in the electronic mode by attesting to the drastic reduction of teacher talk in favor of student production (particularly Sullivan & Pratt, 1996).

There is also anecdotal evidence that backsliding into the L1 is minimized in electronic discussion (Beauvois, 1992; Kelm, 1992; Chun, 1994; but see Kern, 1995). The caveat should be raised here that it is difficult to establish links between the amount of language produced and the relative time that was actually invested in it (i.e., composing messages) because of the individual freedom in electronic discussions to allocate time and effort to several tasks, such as reading others' messages, editing and

revising one's own contribution before sending it, and so forth. In addition, the quantity angle in analyses of CACD discourse does not provide any indication of the extent to which the output in question is competence expanding: sheer amount in practicing what is already known well may not be relevant from a language development viewpoint (Chapelle, personal communication, May 1996).

Quality of Linguistic Production in CACD

This is arguably the area of CACD of most interest for evaluating electronic synchronous discussions and establishing links with L2 development and overall language ability gains. However, very little is known partly because of the scarce research that is available and partly because of the lack of theoretically motivated approaches that guided the few existing language analyses.

It has been suggested that interactional written discourse resulting from electronic communication is linguistically different from both traditional written and oral discourse (e.g., Ferrara, Brunner, & Whittemore, 1991; Yates, 1996; this is the assumption in Chun, 1994, and Kern, 1995), but the extent of those differences and the implications for language learning are yet to be elucidated. As Beauvois (1992) rightly points out, we do not exactly know the extent to which CACD promotes practice of different language skills, such as writing, "conversing," or reading. Furthermore, the discursal status of language produced in electronic interactions seems difficult to determine. Kern (1995) found that the average turn length was similar in both the electronic and non-electronic condition, although simpler, shorter messages tended to elicit more responses than complex, longer ones in the electronic mode. Along the same lines, Kelm (1992) characterized the interactive quality of discourse in CACD as similar to the flow of real conversation, impressionistically estimating that "nearly every computer comment ends with a direct question or a tag question to invite feedback" (p. 445).

Warschauer (1996a), by contrast, reported that exchanges on the computer were longer but the level of interaction was lower "with people expressing their own ideas as opposed to directly answering questions" (p. 10). Overall characterizations and comparisons are complicated by the intervening factor of individual "styles of discussing" in the electronic mode (Chun, 1994, p. 21) that result in some learners contributing with short messages that are closer to oral language, while other learners may produce longer, more substantial turns that stand closer to the written language. Ultimately, it would seem that a learner's perception of the communicative context and interpretation of the task at hand in CACD has an impact on whether the language produced by each individual participant more closely resembles written or oral discourse in terms of both linguistic complexity and degree of interactivity.

Chun's (1994) study provides the most detailed analysis to date regarding interactional features of the discourse of CACD. Chun was interested in examining interactive and functional features of learner discourse that would link CACD to the development of communicative competence (as defined in Canale & Swain, 1980) and "interactional competence" (following Kramsch, 1986). She found that CACD fostered discursal moves such as: (a) topic initiation, own- and other-topic expansion; (b) interactional moves such as clarification requests, comprehension and confirmation checks; and (c) repairs in case of misunderstandings. Thus, her claim that a great variety of functions and interactional moves will be effected when learners engage in electronic discussions was supported. However, Chun did not employ the analytical tools developed in SLA work on interaction and negotiation of meaning (see Long, 1996, for an overview of interactionist theories and research); her analysis of discursal categories draws on the general pedagogical ESL and FL literature. Consequently, not much can be said as to whether the type of interaction resulting from CACD affords learners with the relevant kinds of opportunities for negotiation of meaning that have long been established as conducive to interlanguage development.

The analyses of syntactic complexity conducted by Chun (1994), Kern (1995), and Warschauer (1996a) yielded somewhat conflicting results that only partially support the hypothesis of a greater complexity of the interlanguage produced in electronic discussions. In their studies, Chun (1994) and Kern (1995) found that CACD learner output showed a higher proportion of simple sentences over complex ones. In addition, Kern reports a lower density of complex structures in the InterChange discussions compared to the oral whole-class discussions. In conflict with these results, Warschauer (1996a) compared the coordination index (i.e., syntactic complexity) and the type-token ratio (i.e., lexical range) of the language produced in CACD and face-to-face small group discussions and found that both measures, but especially the coordination index, yielded higher values for the electronic mode. Ad hoc measures such as morphosyntactic range have been used (Kern, 1995) with positive results for electronic discussions that may be biased by confounding differences in total length between conditions. Obviously, a wider range of well-motivated measures of syntactic complexity and lexical range is needed in further studies if the linguistic quality of learner interlanguage in electronic discussions is to be assessed and compared to learner output in more traditional oral and written tasks.

NEW DIRECTIONS FOR RESEARCH IN CACD

CACD and Language Outcomes from an SLA Perspective

As can be surmised from the discussion above, at least two aspects of production need to be separately investigated. First, in order to evaluate the potential of CACD for second language learning and language development, the interlanguage produced over time in electronic discussions needs to be analyzed in terms of quantitative measures of syntactic complexity, lexical range, accuracy, and writing fluency.

Accuracy has not been investigated, under the unanimous assumption that CACD fosters a focus on meaning and, hence, probably results in lower degrees of accuracy (Beauvois, 1992; Kelm, 1992; Kern, 1995). Pellettieri (1997) investigated the provision of negative feedback in dyadic tasks using *ytalk*, a synchronous written environment somewhat similar to InterChange, and found that morphosyntactic aspects of learner output were the target of negotiation and correction moves and that L2 learners seemed to pay attention to form during the electronic exchanges. Indeed, the issue of focus on form and accuracy within CACD interactions stands as a promising area for empirical testing since potential greater opportunities for planning and monitoring in CACD may affect interlanguage accuracy in complex ways (Crookes, 1989; Ellis, 1987; Ortega, 1995), especially when considering the fact that electronic interactions allow learners to allocate attentional resources and use various metacognitive strategies according to individual learning styles and learner orientations to communication. To my knowledge, there is no study that addresses the issue of fluency in writing in CACD. It is worth noting that "fluency" in L2 electronic written discussions (also related to the issue of overall language productivity) may involve the investigation of variables such as typing and computer skills, writing apprehension, and learner attitudes towards computers (see Sullivan & Pratt, 1996) that have long been of interest to educational researchers in the L1 literature (e.g., Hartman et al., 1991).

A second crucial area in need of further investigation concerns qualitative and quantitative analyses of interactional features of CACD discourse that are thought to be relevant in SLA processes and conducive to IL development. These features include but are not limited to interactional modifications of input that result from negotiation of meaning (clarification requests, comprehension and confirmation checks, repairs, self- and other-repetitions, elaborations, expansions), recasts and other forms of corrective feedback, and incorporation of others' input in learner output. Recent empirical evidence seems to confirm the comparability of task-based electronic and face-to-face interactions when these are carried out in dyads (Pellettieri, 1997), but we do not know how "many-to-many" interactions conducted with the aid of the computer constitute, resemble, or differ from face-to-face dyadic and small group task-based

interactions that have been widely investigated in SLA interactionists' studies (e.g., Day, 1986; Gass & Madden, 1985; see also Gass & Varonis, 1994; Long, 1996; Long & Sato, 1984; Varonis & Gass, 1985). I suspect the lack of adjacency between relevant turns and the loss of chronological information (cf. Werry, 1996), both essential when analyzing oral interactional discourse, are two main factors that hinder reliable analyses of important features, such as interactionally modified input and incorporation. In spite of the technical advantages that CACD offers in terms of collecting linguistic data at a minimal effort (being a text-based activity that can be easily stored and displayed for inspection), this methodological problem may render the application of well-established SLA interactionist analysis to electronic synchronous discussions more problematic than initially expected.

Finally, it has been suggested that learners' intake of relevant features of the interactionally modified input (assuming such modifications are found to occur in electronic interactions) may be more easily perceived and more memorable because they occur in text form (Warschauer, 1996b, 1997). Depending on the varying receptive language abilities of individual students, visual information may be processed faster and more easily than aural information and is, in any case, amenable to repeated inspection, acting as a built-in external memory aid (Gallupe, Bastianutti, & Cooper, 1991). Thus, an unexplored but promising research venue in CACD is to investigate the impact of electronic, text-based interactions on SL noticing and awareness (Schmidt 1990, 1993, 1994).

Communicative Competence and Language Skills in CACD

Related to the need to determine the discursual status of the language produced in CACD is the need to ascertain the impact of CACD on the development of various components of communicative competence and of the different language skills (i.e., writing and reading) (Beauvois, 1992; Kern, 1995). Indeed, it is unclear what aspects of communicative competence and language ability are being fostered in CACD and which may be hindered.

Specifically, the nature of the linguistic output produced and the extent to which interaction relevant to L2 learning is involved in CACD remain to be determined. As discussed earlier, the existing studies on CACD in L2 classrooms have at best attempted to explore electronic interactive discourse in comparison with more traditional oral and written modes of language use; they have done so by examining linguistic outcomes alone, and this often with an unfortunate lack of theoretical motivation in the analyses. It would seem more fruitful to concentrate our research efforts on documenting not only differential language outcomes with well-motivated SLA categories and units of analysis, but also learner perceptions and behaviors as they interact with the features of a given CACD task in shaping language performance.

Arguably, a learner's perception of the communicative context and interpretation of the task at hand have a profound impact on the extent to which written or spoken discourse and writing or reading skills are practiced and developed in CACD. Without determining particular learners' uses of language and communication in well-defined CACD settings, we cannot ascertain the validity of otherwise interesting suggestions regarding SL learning and teaching, such as whether CACD promotes the integrated development of writing and reading skills (Kern, 1995), whether transfer from CACD communication skills to the oral mode may be expected (Chun, 1994; Beauvois, 1992), and whether CACD may constitute an ideal bridge from spoken interaction to written composition (Warschauer, 1996a) or from text-supported discussion to free oral expression in the target language (Kern, 1995). A sensible approach to investigating any of these questions will entail: (a) the careful, unobtrusive documentation of the actual processes learners engage in during CACD sessions; (b) well-motivated measures of language performance and development; and (c) comparisons of learners' behavior and task outcomes when previously identified relevant features and parameters of CACD activities are manipulated.

Individual Differences in CACD

Many other aspects of electronic class discussions are unknown to teachers and researchers, although some recent studies have started to address them. For instance, affective variables such as attitudes toward writing with computers and computer-anxiety may play a role in individual differences in learner performance and achievement in CACD (Sullivan & Pratt, 1996; see also Hartman et al., 1991), as may learner aptitude and experience in typing and computer skills. Research on individual differences and CACD to date has focused on personality, attitude, and motivation. Beauvois and Eledge (1996) studied the attitudes of university students toward using Daedalus/InterChange in two third-year French conversation and composition sections and found that both extroverted and introverted students (as measured by the Meyers-Briggs Type Indicator personality test administered at the beginning of the semester) perceived CACD to be beneficial linguistically, affectively, and interpersonally (as manifested in a three-dimension exit survey and interview).

Meunier (1997) followed a similar survey approach with three third-year French and two third-year German composition classes using CACD over the course of one semester. Her research encompassed questions mostly regarding personality (again, using the MBTI questionnaire), and situational and task-related motivation (including language-based and computer-based anxiety, risk-taking, and sociability, as well as intrinsic and extrinsic motivation). She also considered gender and teaching styles among potential factors affecting learner attitude towards CACD. Meunier concluded that CACD fostered highly positive attitudes regardless of the learners' initial motivation and computer background (see also Warschauer, 1996c), and that certain personality types may be more prone than others to experience specific types of anxiety on CACD (e.g., Sensing learners may be prone to language- and accuracy-related anxiety while Feelers may be more sensitive to communication- and flaming-related anxiety). Interestingly, Meunier noted how the teaching styles of the five instructors involved in the study affected learners' attitude and motivation towards CACD: lower motivation rates were obtained in classes where the instructor exercised tight control over the computer-mediated exchanges (i.e., by monitoring and structuring students' contributions during the CACD sessions), or where the electronic discussions were occasional and poorly integrated into the overall course.

Hopefully, future studies can further explore such classroom-related questions. However, research in this direction must enhance the confidence and interpretability of findings by ensuring the sample size is adequate for survey-type investigations of this kind, by documenting and monitoring classroom processes (e.g., teaching styles) and attitude changes throughout the semester, and by establishing direct links between self-reported attitude and perceived benefits, on the one hand, and linguistic outcomes, on the other. In addition, in-depth qualitative investigations are crucial to document posited attitudinal changes towards the foreign language and culture brought about by the use of CACD over time (Beauvois, 1992) and to explore the possible impact of CACD on learner motivation and learner identity (Warschauer, 1996c; 1997).

Another promising research area concerns the use of learner strategies. In particular, metacognitive strategies such as planning and monitoring, which are considered to play an important role in second language performance and acquisition (see Crookes, 1988, for a review of both), seem to be greatly fostered in CACD. As Kelm (1992) rightly describes, "students can read comments at their own pace, type their responses at their leisure, and wait to send messages only when they are completely satisfied with what they have written" (p. 44). All of this is possible without the dangers of being interrupted, making interlocutors become bored or impatient, receiving physical or verbal evaluative signs from the audience, or forgetting one's own ideas while waiting for an opportunity to take the floor. Moreover, unlike many other CALL activities (e.g., drill-and-practice software, simulation games, intelligent tutorials on grammar) that also allow for considerable flexibility and self-pace, electronic synchronous

discussion remains a collaborative, interactive, and time- and space- bound activity, as most oral communication is. Since many-to-many electronic synchronous discussions lessen the communicative stress otherwise involved in on-line communication tasks (Anderson, Brown, Shillock, & Yule, 1984; Givón, 1979; Horwitz & Young, 1991), planning opportunity seems to be greater in electronic discussions than in face-to-face oral tasks.

Likewise, monitoring is possible in computer-assisted discussions because of the freedom to revise and edit a message at will before sending it to all participants, with the methodological advantage that many software applications for synchronous written communication allow the automatic record of all keys typed, including backspaces, deletions, and so forth (e.g., Condon & Cech, 1996; Pellettieri, 1997). The area of monitoring is in need of careful research in computer-mediated communication, since conflicting demands of the particular context and differing attitudes towards accuracy (that may depend on learners' particular orientation towards the task, on personality differences, on teaching styles, etc.) may differentially affect individual monitoring behavior (cf. Meunier, 1997) and, hence, accuracy of the output. In addition to planning and monitoring, resourcing (see O'Malley, Chamot, Stewner-Manzanares, Kupper, & Russo, 1985) is also greatly facilitated by the assistance of the Thesaurus, and the spelling and grammar checks, all of which are available for users of the Daedalus/InterChange software at any time during the CACD session. Although the existing literature has identified the potential benefits of using CACD in relation to enhanced opportunities for strategy use, and particularly for planning and monitoring (Kern, 1995), no research has been done in this area.

A methodological consideration is in order here. Presumably, most of the overt manifestations of monitoring and resourcing behaviors can be described by examining non-linguistic moves that the learner performs on the computer, (e.g., deleting, cutting and pasting, selecting the grammar or spelling check, selecting the Thesaurus). Planning, on the other hand, is a metacognitive strategy that covers a complex range of cognitive and metacognitive psycholinguistic processes which are difficult to inspect through observation and recording of overt behavior only (Crookes, 1988; Ortega, 1996). Hence, a premise to this direction of CACD research is to collect data from sources other than the linguistic output of learners (i.e., the CACD automatically-produced transcripts), by means of techniques that can record reliable information on what overt and covert behaviors learners engage in in the process of computer-assisted interaction. Specifically, empirical descriptions of preferred learner strategies fostered by CACD activities would involve documentation of learners' moves interacting with the computer program, self-reported accounts of learner strategies and attentional focus, and observational data collected by the researcher in the course of the electronic discussion.

"INSIDE THE BLACK BOX" OF CACD: CONCLUDING REMARKS

In this review, I hope to have argued how, ultimately, CACD constitutes yet another potential "black box" in L2 classroom-based research (Long, 1980) if task processes and task conditions are left outside the scope of inquiry. The following methodological and theoretical recommendations for future research on CACD in L2 classrooms have been suggested:

Comparisons of the participation patterns and the language and discourse produced in traditional classroom discussions versus electronic synchronous discussions need to ensure that task features and context variables, particularly group format and size, are truly comparable.

CACD studies which focus on participation patterns and amount and quality of linguistic output will be most useful when well-motivated and well-established categories and measures are employed for the analysis of language and interaction. Specifically, multiple outcome measures and comparisons of accuracy, communicative ability, fluency, and so forth in CACD will need to be motivated in SLA theory

if links with L2 learning are to be established. Assuming that methodological problems in the analysis of non-sequential and asynchronous language data as recorded in the InterChange transcripts are not insurmountable, reliable measures of interactionally-modified input and learner incorporation of that input are crucial in elucidating the role of interactions produced in CACD for SLA.

Rather than focusing on the overall benefits of CACD per se or on general differences between electronic and face-to-face discussions, research needs to move toward explaining how CACD can be used in ways that may have differential consequences for L2 learning by principled manipulation of the array of activity types and task configurations which CACD environments allow. Chapelle (1996) has developed a framework for the description and classification of CALL tasks which is based on an integration of seminal research in systemic linguistics (Halliday, 1978; Halliday & Hasan, 1989), work on pedagogical language tasks by Breen (1987), and more generally the underpinnings of interactionist SLA theory (Long, 1996). Other possible classifications for language tasks have been proposed in the literature and could be equally used for the motivation of research designs on CACD tasks (e.g., Pica, Kanagy, & Falodun, 1993; and Skehan, 1996).

The combination of observation, self-report data collected through questionnaires and think-aloud protocols, and computer-collected data (of both linguistic outcomes and non-linguistic moves) will enhance the internal validity of the studies (cf. Jamieson & Chapelle, 1987) and will enable a more accurate assessment of the ways in which CACD fosters self-regulatory learning and communication strategies and of the impact of such strategies on SL performance in the electronic mode. Establishing links between self-reported and observed behaviors and linguistic outcomes should be a priority in this type of CACD research.

CACD studies need to document and monitor not only processes and outcomes during the CACD sessions, but also other aspects of classroom learning (e.g., teaching style, degree of integration of CACD tasks into the syllabus, etc.) that seem to affect the ways in which learners interpret and perform CACD tasks.

The most promising aspects of networked communication seem to derive from the potential degree of freedom accrued by CACD to L2 learners in terms of choices, priorities, and attentional demands in the completion of tasks, while preserving the collaborative, interactive, and time- and space-bound nature of most oral communication. For teachers and researchers alike, this same flexibility underscores the need to engage in fruitful and systematic inquiry which helps elucidate the relative impact of relevant features of CACD on learner L2 performance and L2 acquisition. To this end, more research is needed on the nature of language, learning, and interaction fostered in networked synchronous communication in L2 classrooms.

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