The Relationship Between Second Language Acquisition Theory and Computer-Assisted Language Learning

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The point of departure for this article is the contrast between the theoretical landscape within view of language teaching professionals in 1991 and that of today. I argue that the pragmatic goal of computer-assisted language learning (CALL) developers and researchers to create and evaluate learning opportunities pushes them to consider a variety of theoretical approaches to second language acquisition (SLA), which have developed, in part, in response to the need to theorize the role of instruction in SLA. To illustrate connections between SLA and CALL, I touch on multiple theoretical perspectives grouped into four general approaches: cognitive linguistic (Universal Grammar, autonomous induction theory, and the concept-oriented approach); psycholinguistic (processibility theory, input processing theory, interactionist theory); human learning (associative–cognitive CREED, skill acquisition theory); and language in social context (sociocultural, language socialization, conversation analysis, systemic–functional, complexity theory). I suggest that such theoretical approaches can be useful in the development and evaluation of CALL materials and tasks. Finally, I propose that the expanding use of technology changes the nature of communicative competence theory, challenges SLA theory, and increases the number of consumers for SLA research.

What is the relationship between a theoretically and empirically based understanding of the language learning process and the design and implementation of technology-based materials? (Garrett, 1991, p. 74)

THIS QUESTION IS AT LEAST AS IMPORTANT today as it was in 1991 when Garrett (1991) posed it in her article in *The Modern Language Journal*, even though the technologies included in the study of computer-assisted language learning (CALL) and the perspectives for theorizing second language learning (SLA) have become more varied and complex. She referred to language acquisition theory that views language as “a dynamic interactive system for conveying meaning,” and language learning as “the acquisition of the ability to construct communicative meaning in a new system” (p. 92). The implication for instruction, as Garrett put it, is that “Since so complex an ability can hardly be ‘taught,’ our job is to create an environment—in class or in our materials—in which students can work on acquiring that ability” (p. 92). The theory Garrett referred to in her article is not named, but in view of the date and the description of implications from the theory, one might infer that she is drawing upon Krashen’s influential ideas that were based on generative linguistics (e.g., Krashen, 1982). Garrett’s point was not to select a theory but to argue that theoretical perspectives were needed to help make sense of the intensively interactive and linguistically rich environments afforded by technology.
Since the early 1990s, much has been written about constructing and evaluating theory in SLA (e.g., see Gregg, 2003; Jordan, 2004), a review of which would lose sight of the topic of this article—the relationship between SLA theory and CALL. Instead, the essential preliminaries can be established on the basis of a recent edited volume that introduces nine current theoretical approaches to SLA. VanPatten and Williams (2007) introduced the book by defining a theory as “a set of statements about natural phenomena that explains why these phenomena occur the way they do” (p. 2). VanPatten and Williams distinguished between a theory and a model, but in CALL, these distinctions, as well as other technicalities about theories, have not been a central concern. Instead, work in CALL has sought ideas—whether they are called theories, models, hypotheses—about how SLA happens that can be used as a basis for decisions that go into the design and evaluation of technology for language learning. In other words, the emphasis in CALL today is on the pragmatic goal of marshalling professional knowledge in a manner that is useful for creating learning opportunities and demonstrating successful learning.

GENERATIVE LINGUISTICS, SLA, AND CALL

When Garrett (1991) wrote her article most of the intellectual energy in SLA theory known to researchers in second language (L2) pedagogy in the United States had been devoted to an agenda influenced by generative linguistics. The primary concern was on SLA as a natural phenomenon unaffected by instruction. Despite the distance between generative linguistic theory and instruction, this perspective for examining acquisition was influential, and therefore it was incorporated into thinking about language instruction, in general, and CALL, in particular. Underwood’s 1984 book, *Linguistics, Computers and the Language Teacher*, played out the implications of Krashen’s (1982) monitor theory for CALL by explaining how they suggested premises for communicative CALL. Premises were expressed as statements that developers of CALL activities could draw on in making pedagogical decisions. Premises included that communicative CALL would “aim at acquisition practice rather than learning practice,” “not try to judge and evaluate everything the student does,” and “use the target language exclusively” (pp. 52–53). The thrust of these premises is that the computer is to provide comprehensible input to learners rather than what most instructional designers would consider instruction.

Generative linguistics and its successors such as Universal Grammar (White, 1989) and autonomous induction theory (Carroll, 2006) are similar to focusing on natural rather than instructed SLA. Such theories focus on explaining how innate mental structures are responsible for a learners’ development of language. They theorize that acquisition requires linguistic input from the environment from which the learner infers linguistic structure, but as the focus on this theory is the prewired linguistic capacities of learners rather than the input, implications for materials and tasks are limited, perhaps just to assessing language knowledge, or as Underwood (1984) suggested, to providing comprehensible input.

Garrett’s (1991) questions about instructional design press far beyond the scope of generative linguistic theory. For example she asked,

> For which learners at what level for what purpose can error analysis be most helpful? Should students engage only with “natural” authentic language? Or should they (instead, or also, or first) engage with language which has been pre-digested, organized by pedagogical or linguistic principles? (p. 93)

She asked how instruction could be tailored to meet the needs of individual students, pointing out, “Recent research on specific differences in the way learners approach learning tasks strongly suggests that true individualization of CALL materials should provide alternative approaches or presentations for students . . . Sophisticated programs should eventually allow students to choose from a variety of approaches” (p. 93). In other words, whereas generative linguistics assumes input, CALL designers need to be able to theorize the role of various types of input for learning because they have the option of selecting, sequencing, and modifying input.

These and other issues of instructional design raise questions about which generative linguistics has nothing to say. CALL designers, users, and researchers need to be able to theorize not only the “normal” process of acquisition but also how to modify this normal process in hopes of helping students to learn faster and better. In raising important instructional design issues, Garrett exhibited the pragmatism that remains evident in CALL today as researchers draw on whatever perspectives might help them to grapple with the many new possibilities presented by technology. In part due to such pragmatic needs (i.e., perspectives relevant to instructed SLA), SLA theory has moved beyond the narrow program of generative linguistics in ways that are relevant to L2
instruction, in general (Ortega, 2005), and CALL, in particular.

EXPANDING THE THEORETICAL LANDSCAPE

Doughty (1987) explained the interconnectedness between SLA theory and CALL through a discussion of Krashen’s monitor theory, as well as information processing theory (McLaughlin, Rossman, & McLeod, 1983) and interaction theory (Gass & Madden, 1985). She argued that theory needs to play a central role in designing CALL research that will ultimately inform practice and that the use of the computer to deliver instruction and collect data opens the possibility for more precision and control in data collection. For example, Doughty’s (1991) study on the acquisition of relative clauses in English used CALL as a means of delivering the conditions for learning, which were developed on the basis of theoretical predictions about input salience and the relative value of form-based and meaning-based instruction. She raised issues of how learner–computer interactions can be gathered and used to infer learners’ processes and strategies that are relevant from the perspective of a particular theory (e.g., students’ time to respond might be used to infer whether processes are controlled or automatic, an issue of central concern in information processing theory). Thus, by expanding the theoretical discussion, Doughty was able to make some links between theory and the two major strands of computer-assisted second language research: assessing effects of instructional conditions and gathering evidence of learners’ knowledge and strategies (see Chapelle, 2001, ch. 5).

Over 20 years later, a number of theoretical approaches to SLA have been explored, each focusing on a particular area of language learning (e.g., Ellis, 1994; Gass & Selinker, 2008). The volume by VanPatten and Williams (2007) is particularly useful for considering the variety of perspectives on SLA because it explicitly addresses the question of the relevance of each theory to language teaching. Table 1 lists the theoretical approaches to SLA from the volume that have been influential as well as three approaches mentioned by Ortega (2007) in the final chapter and complexity theory as described by Larsen-Freeman and Cameron (2008). The second column in Table 1 provides an indication of the theoretical focus and the third column suggests an aspect of CALL that might be informed by the theory. One might make similar observations for curriculum and instruction more generally; however, aspects of instruction such as individualization of curriculum and materials are arguably more realistically accomplished through technology.

Cognitive Linguistic Perspectives

Cognitive linguistic perspectives such as Universal Grammar, autonomous induction theory, and the concept-oriented approach (Bardovi-Harlig, 2007) are concerned with the learners’ internal mechanisms responsible for linguistic development. Universal Grammar and autonomous induction theory attempt to discover a natural development of structural grammatical knowledge, whereas the concept-oriented approach aims to describe how learners make form–meaning mappings based on the input they receive. These theories view the effects of instruction as limited to what the natural sequences of development dictate. Potentially relevant for instruction, however, are specific findings about the order of acquisition, which might be exploited for developing individualized instruction.

As Garrett (1991) pointed out, the idea that “the individual student’s own hypotheses have to be actively tested” (p. 92) was then and remains today one of the theoretically important aspects of SLA where CALL offers great promise. For example, exercises based on students’ use of corpora for investigating grammatical patterns provide rich activities for individual hypothesis testing. These cognitively based theories suggest some orders of acquisition of grammatical form, providing concrete suggestions about sequencing that could be exploited in a grammatically based curriculum. Although these theories are not concerned with accelerating learning, they are consistent with the idea that appropriately sequenced instruction might be able to speed up the process of acquisition. Like Purpura’s (2004) estimate of the utility of such SLA findings for the assessment of grammar, however, the range of grammatical structures studied results in a rather narrow scope of the theoretical implications for design of curriculum, even if one wishes to design a curriculum on the basis of grammatical structures.

Psycholinguistic Perspectives

Processibility theory also aims to explain natural language acquisition in the absence of instruction, but it does so by describing the “architecture of the language processor” responsible for processing the L2 input. The language processor provides a means of understanding the sequence in which language structures can be
TABLE 1
Theoretical Approaches to Second Language Acquisition, Their Focus, and Example Implications for Computer-Assisted Language Learning

<table>
<thead>
<tr>
<th>Theoretical Approach to SLA</th>
<th>Focus of Theory</th>
<th>Example Implications for CALL</th>
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<tbody>
<tr>
<td><strong>Cognitive Linguistic Approaches</strong></td>
<td></td>
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</tr>
<tr>
<td>Universal Grammar</td>
<td>Internal linguistic mechanisms</td>
<td>May provide a basis for sequencing grammatical forms in a syllabus for individualized learning</td>
</tr>
<tr>
<td>Autonomous Induction Theory</td>
<td>Internal linguistic mechanisms</td>
<td>May provide a basis for sequencing grammatical forms in a syllabus for individualized learning</td>
</tr>
<tr>
<td>Concept-Oriented Approach</td>
<td>Linguistic mechanisms for making form–meaning connections</td>
<td>May provide a basis for sequencing the teaching of form–function mappings in individualized learning</td>
</tr>
<tr>
<td><strong>Psycholinguistic Approaches</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processability Theory</td>
<td>Psycholinguistic processes for comprehension and production</td>
<td>Provides a basis for sequencing the teaching of grammatical structures in individualized learning</td>
</tr>
<tr>
<td>Input Processing</td>
<td>Psycholinguistic mechanisms for making and learning form–meaning mappings</td>
<td>Provides a basis for suggesting the format of instructional materials to draw learners’ attention to target form–meaning mappings</td>
</tr>
<tr>
<td>Interactionist</td>
<td>Psycholinguistic processes for language learning through noticing language during meaning-oriented tasks</td>
<td>Provides a basis for suggesting meaning-oriented activities that engage learners’ attention to form.</td>
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<tr>
<td><strong>General Human Learning</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associative–Cognitive CREED</td>
<td>Cognitive mechanisms for perception and learning of linguistic patterns</td>
<td>Provides suggestions for learning through repeated exposure</td>
</tr>
<tr>
<td>Skill Acquisition</td>
<td>Cognitive mechanisms for learning through practice</td>
<td>Provides suggestions for learning through practice and for assessment of successful learning</td>
</tr>
<tr>
<td><strong>Approaches to Language in Social Context</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sociocultural</td>
<td>The context in which learners communicate</td>
<td>Points to contextual factors such as time, place, and mediating technologies that are relevant for communication</td>
</tr>
<tr>
<td>Language Socialization</td>
<td>Communities and their practices</td>
<td>Provides concepts and terms for analysis of how learners’ identities as language users evolve through group participation</td>
</tr>
<tr>
<td>Conversation Analysis</td>
<td>Language used for social action</td>
<td>Provides methods for analysis of how learners accomplish social action through conversation</td>
</tr>
<tr>
<td>Systemic–Functional</td>
<td>The linguistic resources used to make meaning</td>
<td>Provides terms and concepts for analysis of how learners’ language constructs meaning</td>
</tr>
<tr>
<td>Complexity Theory</td>
<td>The interplay among cognitive and contextual factors</td>
<td>Provides a conceptual framework for the integration of various facets within a system</td>
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</table>

processed, thus constraining the order of acquisition (Pienemann, 2007). Because the hypothesized order of acquisition is based on processing principles, materials developers wishing to use this perspective for sequencing materials might extrapolate from the data that form the basis of the theory to other grammatical structures they wish to include. Therefore, the potential scope of implications from this theory is broader.
Input processing theory (VanPatten, 2007) also includes a psycholinguistic processing perspective, with principles that can be applied to a range of issues in the selection of material. Unlike processability theory, however, the focus of input processing theory is the nature of the input and activities that are likely to prompt noticing of form–meaning mapping. The perspective underlying processability theory is that certain hypothesized psycholinguistic processes are responsible for comprehension and acquisition (Gass, 1997). VanPatten developed specific principles concerning processing that provide a basis for development of materials. The key point is that learners are to primarily attend to meaning in the input they receive; in addition, input needs to be accompanied by exercises that help learners to notice specific aspects of the input—those predicted to be difficult on the basis of comprehension strategies such as expectation of the canonical word order of S–V–O. Intended to be productive in making suggestions about the design of materials and instruction, input processing theory appears to provide a rich source of ideas for the design of CALL tasks.

Input processing might be seen as one development arising from the perspective on processes of comprehension and learning which underlies the cognitive interactionist perspectives of Gass (1997), Long (1996), and Pica (1994). Whereas input processing has not been explored very much in CALL, interactionist theory has been drawn upon for a range of practical needs in CALL, from the design of materials and tasks to the conceptualization of research on CALL and interpretation of results (Chapelle, 2005). For example, specific suggestions such as the following for CALL tasks are intended to engage learners in interactions that help them to draw connections between form and meaning: (a) Make key linguistic characteristics salient by highlighting and providing opportunities for repetitions and modifications for particular forms and (b) support modified interaction between the learner and the computer by providing the learner with control over when to request help, modify responses, and get access to repetition and review (Chapelle, 1998).

Both experience and the professional literature indicate that such theory-based principles have been used in both commercial and academic development of multimedia materials over the past 10 years, reflecting a link between SLA theory and CALL practice that barely existed years ago. My experience suggests that such links are not as evident in the professional literature as they are in practice, where developers tend to create materials rather than write about their work developing materials. In seeking empirical evidence for the value of such suggestions, however, one can find a number of studies that compared the effects of a design that one would expect (based on interactionist theory) to be superior with those of one that would be expected to be less successful. Table 2 summarizes some such studies and their interpretation in view of interactionist SLA.

The studies cited in Table 2 illustrate the learning that occurs during learner–computer interaction in which learners are attempting to comprehend or produce meaningful language in contexts where the language and interactions have been designed for learning. The interactions of interest are those showing that the students are obtaining help with comprehension or feedback on their production. When learners request help, in the form of first language glosses, L2 glosses, images, grammatical simplifications or restatements, they have an opportunity to comprehend the language in the original input. This process would be expected to have positive effects on comprehension, and results from this research are consistent with this prediction. When learners receive feedback from the computer on their production, they have the opportunity to notice gaps and correct errors. Psycholinguistically, these processes mirror those that are hypothesized by interactionist theory to be so valuable in conversation. Empirically, the results of these studies, which continue today (e.g., Yanguas, 2009), have supported the superiority of conditions that allow for such help with comprehension and informative feedback.

Whereas learner–computer interaction may not be an obvious domain for extrapolating interactionist theory, many studies of computer-mediated communication have drawn on this theory to conceptualize the results. It is now commonplace to investigate online communication tasks by drawing on the concepts of negotiation of meaning and negotiated interaction, although the first such studies took place only a few years ago (Blake, 2000; Pelletieri, 2000). Pelletieri found that communication tasks using text chat provided an environment in which learners engaged in negotiation of both form and meaning as learners corrected themselves and each other. Blake identified episodes of negotiation of meanings in communication tasks performed through written synchronous communication.

Payne and Whitney (2002) extended this line of research by investigating the comparative effectiveness of written chat with oral conversation in intermediate Spanish classes.
TABLE 2
Example of CALL Instructional Strategies Interpreted Through Interactionist SLA From a Psycholinguistic Perspective

<table>
<thead>
<tr>
<th>Instructional Strategy</th>
<th>Focus of Research</th>
<th>Cognitive Interactionist Interpretation</th>
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<tbody>
<tr>
<td>1. Offering help for comprehension of aural input through written L2 support</td>
<td>Video input with L2 subtitles (Borrás &amp; Lafayette, 1994) Help with comprehension through L2 subtitles and with keywords (Guillory, 1998)</td>
<td>L2 subtitles might provide modified input Both types of help would provide modified input and the keywords should make particular linguistic forms salient</td>
</tr>
<tr>
<td>2. Offering help for comprehension of aural input through L1 support</td>
<td>Help with lexical and sentence interpretation with sentence-level translations (Grace, 1998)</td>
<td>Sentence-level help would provide modified input and prompt noticing</td>
</tr>
<tr>
<td>3. Offering help for comprehension of written input with multiple supports</td>
<td>Reading texts with help for vocabulary with multiple forms of annotations (Chun &amp; Plass, 1996) Help with vocabulary in listening with verbal and visual annotations (Jones &amp; Plass, 2002) Help with vocabulary in reading with multiple forms of annotations (Plass, Chun, Mayer, &amp; Leutner, 1998)</td>
<td>Multiple forms of help might make input salient and provide modified input Multiple forms of help might make input salient and provide modified input Multiple forms of help might make input salient and provide modified input</td>
</tr>
<tr>
<td>4. Offering precise explanatory feedback on errors</td>
<td>Informative feedback on linguistic errors (Nagata, 1995)</td>
<td>Informative feedback would provide an opportunity to notice gaps and correct errors</td>
</tr>
</tbody>
</table>

Note. Adapted from Chapelle (2007, p. 102). CALL = computer-assisted language learning; L1 = first language; L2 = second language; SLA = second language acquisition.

Replacing half the time spent in oral conversation with written chat, the students who participated in the written-plus-oral condition outperformed those in an all-oral conversation class. Focusing on benefits for specific aspects of language, de la Fuente (2003) found that computer-mediated communication (CMC) and oral face-to-face interaction were equally effective for vocabulary learning, except for oral production of words for which oral face-to-face was better. Smith (2004) also investigated negotiated interaction in CMC, finding that lexical items negotiated in online communication were more likely to be retained. Furthermore, Fernández-García and Martínez-Arbelaiz (2003) compared written online and spoken face-to-face conversation, finding more communication breakdowns and negotiation episodes in the oral face-to-face conversations than in the written for dyads of native and nonnative speakers. Jepson (2005) compared voice chat with online written communication, finding that the former generated more repair moves than the latter. Other studies have found plenty of examples of negotiation of meaning in online written communication tasks. The research can be interpreted to suggest that such tasks, as a supplement to face-to-face communication tasks, are valuable for learners insofar as teachers plan them and guide learners (Blake, 2000; Blake & Zyzik, 2003; Kött, 2003; Lee, 2001). However, comparative research has found that indicators of misunderstanding are more frequently explicit in written tasks than in oral conversation (Fernández-García & Martínez-Arbelaiz, 2002).

Input processing and interactionist theories are concerned primarily with how learners process L2 input to make form–meaning mappings that are essential for ultimately incorporating new items into their interlanguage knowledge and ability for use. These theories are rich in generating specific ideas that can be used in designing and investigating CALL, with particular focus on how input is presented and used for interaction. However, these theories have much less to say about the actual integration of comprehended language into the learners’ own system—in other words, the factors associated with learning.
Theories such as the associative–cognitive CREED framework (Ellis, 2007) and skill acquisition theory (DeKeyser, 2007b) focus on language learning as a process of human learning. They conceptualize SLA by processes similar to those that govern other human learning, the associative type of learning consistent with behaviorist views as well as cognitive learning, which include a range of processes including those that can be affected by instruction. The account of the associative–cognitive CREED theory described by Ellis (2007) suggests that learning occurs through repeated exposure, a perspective related to connectionism. Although Ellis did not suggest pedagogical implications, the idea is obviously a kernel that could be useful for the development of CALL materials and tasks. Tasks would be designed in such a way as to provide learners with optimal amounts and circumstances of exposure to the targeted linguistic areas to be learned.

Skill acquisition theory applies principles from cognitive psychology to the specific challenges of language. Language is viewed as a skill that is learned through practice, which provides opportunities for developing declarative into procedural knowledge as language use becomes more automatic. Declarative knowledge refers to knowledge of facts (such as rules for grammatical accuracy), whereas procedural knowledge refers to knowing how to do something (such as using the grammar to speak accurately). The implications for learning through technology are numerous because the theory posits an important role for practice, including systematic input, interaction, production, and feedback in learning (DeKeyser, 2007a).

Language in Social Context

In contrast to the largely cognitive perspectives on SLA previously described, other theoretical approaches to SLA focus on language in a social context. The use of Internet technology for telecollaboration has been one impetus for an expanded theoretical framework drawing on sociocultural theory (e.g., Lantolf, 2000; Lantolf & Thorne, 2006). Belz and Thorne (2006) pointed out that telecollaborative pedagogies engage a broader set of issues than those raised by CALL for classes or individuals. Such pedagogies aim to develop intercultural competence through telecollaborative projects with people from other cultures, who can provide valuable feedback for the development of learners’ language (including pragmatics) as well as potential social relationships. In doing so, the pedagogy raises issues of intercultural tensions, negotiation of language and identity, as well as social and institutional contributions and constraints. With these dynamic and broad-based factors coming into play in pedagogical decisions, SLA theory needs to encompass the learner, teacher, language, technology, and institution, as well as how power relations intersect with these factors in ways that are beyond the control of the teacher. From this perspective, the communication the language learner engages in with peers and others using the target language is critical to the development of language and intercultural competence. Moreover, communication succeeds when multiple contextual factors come together to create ideal circumstances. It follows that pedagogy should be designed in a way that keeps the communication flowing without fatal breakdowns caused by conflicting activity systems among participants (Russell, 2001; Thorne, 2003).

Sociocultural theory can encompass a wide range of areas, including the people and their practices that foster language learning, the use of language as a means of social practice in conversations, and the development of a grammatical repertoire that allows learners to increase the meanings that they can interpret and construct. Systemic–functional linguistic theory provides a means of theorizing development of L2 grammar for meaning making in context. Conversational analysis offers a perspective on interpersonal communication as it is used to accomplish action in context. Language socialization theorizes constructs that are relevant to learners’ engagement in particular contexts. Ortega (2007) pointed out that these socially attuned perspectives theorize experience by drawing on constructs of agency, power, and identity. They treat “social experience as an object of study rather than as random noise that needs to be eliminated from theory development” (Ortega, 2007, p. 247).

Combining Theories?

An attempt to draw on any one of these theoretical approaches to SLA to inform the design and evaluation of CALL reveals its limited scope. Each theory focuses on a set of phenomena, whereas CALL activities can span a broad range of learning opportunities. CALL can be used for providing practice with specific aspects of grammar, vocabulary, and pragmatics; it can be used for providing opportunities for comprehensible input and interaction. Technologies
are also used to offer help though dictionaries, corpora, and search mechanisms. They are used to expand learners’ experience with communities in which the target language is spoken and to connect them with individuals who engage in such practices as codeswitching (e.g., Thorne & Black, 2007). The SLA theories outlined here give a hint of the potential scope for anyone wishing to link research and development of language learning technologies with current perspectives on SLA.

In this landscape, one cannot help but look for a balance—a perspective for combining these approaches into a metatheory that would put the theory pieces together to create a fuller picture. This is the idea behind complex systems theory—for theorizing the multiple factors working together simultaneously—which has recently been explained in terms of its potential for conceptualizing and studying SLA. Larsen-Freeman and Cameron (2008) stated, “Complexity theory aims to account for how the interacting parts of a complex system give rise to the system’s collective behavior and how such a system simultaneously interacts with its environment” (p. 1). Complex systems can be any multicomponental system—such as a student, a set of people contributing to a wiki, or a classroom, including the students, teacher, computers, and other materials—in which behavior and change arises from interacting components. One can find complexity theoretical discussion of a wide variety of phenomena, particularly those that are difficult to model through concepts such as variables and models such as linear prediction. Larsen-Freeman and Cameron extended complex systems theory to L2 learning as a means of moving beyond issues that have proven problematic for applied linguists, including the dichotomy between performance and competence, the accumulation metaphor for acquisition of grammar, and the disconnect between that which is taught and what is learned. Whereas the ideas behind complex systems theory are relatively new and not fully developed, its promise for SLA theory within the larger systems of learning make it worthy of attention.

THEORY AND CALL EVALUATION

The need for an integrated set of theoretical perspectives of what comprises exemplary language learning materials and tasks is evident throughout past work in CALL. For example, Egbert, Chao, and Hanson-Smith (1999) framed their volume on CALL based on Spolsky’s (1989) conditions for SLA drawn from a range of theoretical perspectives. These conditions spanned the cognitive, psycholinguistic, and social needs of learners. Doughty and Long (2003) built the conceptual bridge from theory to materials by outlining methodological principles of task-based language for use with technology. These encompass learning activities (e.g., using tasks, not texts, as the unit of analysis); input (e.g., elaborating input); learning processes (e.g., providing negative feedback); and learners (e.g., individualizing learning).

Evaluating CALL provides a particularly rich challenge, demanding a holistic view of materials and their use without losing sight of specific theoretical implications. If technology-based materials and tasks are to be evaluated in terms of the opportunities they provide learners for SLA, then frameworks and guidelines are needed for conducting such evaluations. Drawing on the concepts and practices used in evaluating tests, Chapelle (2001) outlined a framework and principles for evaluation of CALL, which provide a means of drawing on SLA theory in the concrete work of evaluation.

The framework defines six characteristics of materials that one may wish to make claims about in conclusions drawn about the materials. The first is language learning potential, which motivates examination of factors such as the quality of the interactions learners engage in (from interactionist theory), the utility of the selected input for acquisition of particular areas (from input processing theory), and the quality of the practice learners receive (from skill acquisition theory). The second is meaning focus, which prompts researchers to examine the extent to which learners have rich, interesting input that provides an opportunity to comprehend and/or produce meaning (from all theories except skill acquisition theory). The third is learner fit, which refers to the level of the language, which is particularly critical to the cognitive and psycholinguistic theories. Authenticity is the fourth; a claim about authenticity requires demonstration about the linguistic match between the language that learners see in the instructional tasks and language that they will engage with beyond the classroom. This aspect can be examined through a systemic linguistic analysis. Positive impact refers to the benefits—not necessarily linguistic—that learners might derive from working on the tasks. Sociocultural theory and language socialization approaches are particularly attuned to investigating the way that participation in the activity systems during language learning may be beneficial beyond the experience. Practicality—the degree to which learners have access to and skills needed for work on the
tasks—brings in the real-world factors that greatly influence success.

It is one thing to lay out important factors that go into good language learning materials and tasks, but evaluation requires that such perspectives be operationalized in a defensible evaluation of materials for a particular context. The groundwork for such evaluation projects is an iterative process of stating ideals for the materials based on the theoretical framework and providing a judgmental analysis of the degree to which the desired features actually appear in the materials. Features include opportunities for learners to obtain help through interaction with the program, learners’ focus on the meaning of the language, and the appropriateness of the level and activity fit for the learners (Chapelle, 2001). Such a study can draw on the perspectives of teachers and researchers, and may employ small numbers of students’ judgments as well. An example of this type of work is a judgmental evaluation of Longman English Interactive (Jamieson, Chapelle, & Preiss, 2004).

The next level of evaluation is empirically conducted in the classroom or at the actual site of use. In the Longman English Interactive evaluation, we conducted the next phase in one classroom in a community college in New York, using surveys, classroom observations, and interviews (Jamieson, Chapelle, & Preiss, 2005). Wishing to assess the generalizability of the findings concerning each aspect of the framework, a second, larger empirical analysis was conducted using surveys and teacher interviews. Three U.S. schools had intensive English programs—in Arizona, New Jersey, and New York; the majority of these students were immigrants or international students wanting to improve their English to attend a college in the United States. Two hundred twenty-one students and 10 teachers from six schools participated in the study. In each of these levels of evaluation, the six aspects of the framework provided a stable set of features about which data were collected and conclusions were drawn (Jamieson & Chapelle, 2008).

This series of studies illustrates how theory-based ideas about SLA were extrapolated into principles, the principles operationalized into materials, and the materials evaluated through the same theory-based perspectives. During this process, the theory is called on as needed for hypotheses about how SLA takes place and for constructs to focus on in materials development and evaluation. Whereas 20 years ago the theoretical options to be applied to CALL were limited and this process would have been more difficult, today the theoretical landscape is more fully developed. Looking to the future, one might hope for this theory-practice interface to continue to have a positive influence on the other side of the SLA-CALL link.

THE RELEVANCE OF TECHNOLOGY FOR SLA THEORY

The power of technology as a medium for supporting new kinds of language learning activities is multiplied by its potential for an unprecedented integration of research and teaching. A CALL lesson which creates an environment for some interesting language learning activity could be fitted with a program collecting data on how the learner makes use of that environment, and those data can not only feedback into improving pedagogy but can also contribute to the development of second language acquisition theory. (Garrett, 1991, p. 94)

The image Garrett painted has played out over the past years as computer technology has been used as a tool for testing theoretically based predictions and gathering assessment data (Chapelle, 2001, chap. 5). In 1991, however, it would have been difficult to imagine the extensive integration of information and communication technologies into the lives of language learners and, thus, its multiple intersections with SLA within formal schooling and beyond. Not long ago, for example, the prevailing view in applied linguistics was that human-computer interactions were too far-fetched to be worthy of serious theorizing from the perspective of SLA, but today it is completely normal to communicate with a computer through automated voice systems, interactive text, and combinations of these. In the early 1990s, computer technology was seen as something that teachers could choose to add to other learning materials and activities, but today researchers investigate how, when, and why learners choose various technologies for communication and learning. These changes in the role of technology add dimensions to communicative competence and challenges to SLA theory as well as the size of the pool of consumers for SLA research.

Communicative Competence

Anyone who uses technology to produce, comprehend, and interact in an L2 today is easily convinced that communicative competence is tied to the technologies chosen and used. Those able to contrast today’s communication with that in the pre-computer-technology era recognize that communicative competence cannot possibility be
defined in the same way that it once was. The metaphors concerning the computer as an extension of brains as a means of storing reference materials are as apt for L2 use as for any complex task. Because learners communicate through technology, communicative competence needs to include the ability to communicate using readily accessible L2 technology aids (such as online bilingual dictionaries and tools that check grammar), the ability to make appropriate linguistic choices in face-to-face, remote, written, and oral modes, and the ability to choose appropriate technologies for communication and language learning.

**Contexts, Input, and Interaction in SLA**

Technology dramatically extends and changes the breadth and depth of exposure that learners can have with the target language and interactive events in which they have the opportunity for language focus. Moreover, many of the interactions learners have with the computer take place using written language, which creates different processing conditions than those during oral face-to-face conversation. As a consequence, all approaches to SLA that theorize a role for linguistic input need to consider the way that technology changes linguistic input and how learners’ access to new forms of input might affect acquisition. Specific features of technology are relevant to important aspects of interaction, such as timing, directing attention, multimodality and access to help, and feedback (Chapelle, 2003, ch. 5).

Whereas the study of psycholinguistic conditions that are prompted by task features has been a mainstay in the study of SLA, technology has provided some of the impetus for expanding the study of SLA to other factors, including strategies, intercultural competence, access to technology, and knowledge of its use. Technology researchers like Kramsch and Thorne (2002), Lam (2000), Thorne (2003), and Warschauer (1999) have pointed out that learning through technology depends critically on learners’ access to and use of technology, factors controlled by circumstances that may be only partly under the learner’s control. Theoretical perspectives of language socialization, sociocultural theory, and activity theory open the theoretical lens to encompass the learner in context, thus making space for relevant factors such as learners’ agency and identity, which affect opportunities for learning. Lam and Kramsch (2003) demonstrated that the study of significant technology uses by L2 learners may require an ecological perspective of SLA (van Lier, 2000).

**Expanding the Audiences for SLA**

Technology-based approaches to L2 teaching have prompted greater interest in SLA among a growing circle of professionals. Whereas in the past, research in SLA had a limited following, research regarding how learners use technology for L2 learning—and particularly how to optimize this learning—holds interest to a much wider set of people, including teachers, learners, business people, and governments. In the current climate, people are accustomed to looking to technology as a means of improving efficiency and increasing results. Based on their work with technology in other domains, most people would probably readily agree that technology alone is not the answer, but that a real solution will draw on technology in a manner that is informed by professional and scientific knowledge about SLA.

This link between theory and practice has never been developed with much demonstrable success throughout the many years that books and language laboratory materials have been written and used. As a result, current textbooks, workbooks, and classroom practices seem to be driven by the idea that professional judgment and practice are sufficient to produce the desired goals. Working in the area of language materials development, Tomlinson (2003) suggested principles extrapolated from research on SLA. These principles assert that materials should achieve impact, that they should expose learners to language in authentic use, and that learners’ attention should be drawn to linguistic features in the input (Tomlinson, 2003, p. 21). Writing about materials evaluation, Ellis (1998) suggested the need for empirical SLA theory-based evaluation for language learning materials. However, these ideas are innovative relative to the widespread view that textbook writing is a creative art and that evaluation can be accomplished on the basis of teachers’ judgments alone. Technology can bring to language learning materials a novelty and expense, which create an opportunity for multiple forms of rich input and interaction as well as a data collection capacity unknown to authors of paper materials. The result has been an unprecedented attention to SLA theory and push for practice-relevant theory that can inform the design and evaluation of technology-based materials.

**CONCLUSION**

Over the past 20 years, SLA theory has been productively mined for insights into the design of materials, for guidance on the evaluation of
materials and tasks, and for the design and interpretation of research. During this time, the nature of the SLA theory familiar to researchers working in pedagogy in the United States has evolved, as has the range of SLA theories that can be drawn on for developing pedagogy and conducting research on CALL. The hegemony of generative linguistic theory that says nothing about instruction has given way to theoretical approaches that focus on factors that can be designed and shaped to be beneficial for a learner’s development of communicative competence. With these advances in theory as well as the interest on the part of those designing CALL, the future looks bright. At the same time, however, advances in technology outpace advances in language learning practices; thus, Garrett’s (1991) observation is as true today as it was in 1991: “Technology that can be taken for granted is already light years ahead of the profession’s ability to integrate a principled use of it into the classroom and the curriculum” (p. 74). What was not true in 1991, and may be today, is that the majority of professionals in language learning and teaching see this as an area worthy of attention.

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REFERENCES


