# Language Teaching and Language Technology

John Nerbonne, Sake Jager, Arthur van Essen
University of Groningen

## 1 Motivation

The papers included in this volume concern Computer- Assisted Language Learning (CALL), and are a selection of those presented at the conference *Language Teaching and Language Technology*, held on April 28-29, 1997 at the University of Groningen. The conference was organized to promote an exchange of ideas on how best to harness language technology to improve language teaching. The conference organizers felt that communication would be useful on the one hand to language educators, who need to understand language technologies if they are to use applications built on them intelligently, and on the other to language technologists, who ought to understand the needs of end users and customers in this application area. More specifically, we questioned why it was that existing CALL programs and packages seemed to make little use of language technology.

The last question may sound paradoxical: After all, aren't CALL programs by definition language technology? But in fact CALL programs make very little use of language technology. An appreciation of this point requires some elaboration on LANGUAGE TECHNOLOGY. By this we understand technology which carries out tasks specific to language. In the past, the technology in question involved specific hardware (for speech analysis), but we can restrict our attention to software, as we focus on contemporary systems. We cannot define "tasks specific to language", but we may illustrate what we mean by way of examples.[1] Some of these tasks are:

**speech recognition** given spoken input, find the word or phrase it is a pronunciation of

**lemmatization** given an inflected word, find its lemma (dictionary form)

**syntactic categorisation** (also known as "Part- of-Speech (POS) Disambiguation"). Given a word in context, what is its syntactic category? Consider English *left*, which can be a noun (*on the left*), verb (*She left*), adjective (*the left side*), or adverb (*Turn left!*).

**vocabulary extraction** given a text, extract the histogram of lemma frequencies

**parsing** given a sentence, what is its structure? What is the subject, what is the main finite verb?

**text generation** given an abstract characterisation of a response, put it into grammatical prose

[1] See Cole, Mariani, Uszkoreit, Zaenen & Zue (1996) for a recent, comprehensive survey on language technology.

**speech synthesis** given a written text, generate the sounds of a good pronunciation

Although CALL employs the computer to assist in language teaching and in language self-study, it primarily uses non-language technology:

**hypertext** to provide varied access to exercises and explanatory material;
**digital audio and video** to vivify examples of language use;
**(simple) database technology** to record and present student work; and
**network communication** to bring learners and teachers into easier contact.

This is appropriate and successful, which just poses the question more insistently: *shouldn't language technology be applied to language teaching?*

This question has not been, and probably cannot be answered with an unequivocal 'yes'. On the contrary, Salaberry (1996, p.12) assesses the suitability of language technology for CALL quite negatively:

> Linguistics has not been able to encode the complexity of natural language [...] That problem has been acknowledged by the most adamant proponents of Intelligent CALL [ICALL (NJvE)]. Holland (1995) lists the reasons that have prevented ICALL from becoming an alternative to CALL. The most important reason for this failure is that NLP (Natural Language Processing) programs—which underlie the development of ICALL—cannot account for the full complexity of natural human languages.[2]

We see Salaberry as guilty of a fallacy of division—assuming that what is true of the whole must be true of the parts. So while it is true that faithful models of human linguistic behavior are likely to remain beyond the reach of language technology for many years, perhaps decades, the same is not true of many subdisciplines. Phonological and morphological descriptions of many languages are quite complete—and massively more reliable than the analyses of most language teachers, so that their accuracy cannot be the stumbling block to effective CALL. Furthermore, it is simply as untrue of computers as it is of human beings that effective pedagogy depends on perfect knowledge. Several of the contributions to this volume support the point that imperfect modules—incorporating e.g. grammars and parsers—can effectively assist in language instruction.

But we agree with Salaberry and others about how the issue should be decided: it is not the technology per se, but the contribution it might make to teaching and learning that determines its usefulness for CALL. This contribution may be viewed from different perspectives: pedagogy, technology, their felicitous, cooperative deployment. Pedagogically, we wish to know whether a given application stresses e.g. grammatical analysis, or drill and repetition, or perhaps communicative facility. Technologically, we are interested in the reliability, speed, and range of the algorithms used and the programs realizing

[2] Salaberry's reference to Holland (1995) is not accompanied by bibliographic information.

them. And naturally we cannot neglect the manner in which the technology is harnessed to the pedagogy or the larger context within which it is used (e.g. as a stand-alone course or module, within a supervised or unsupervised laboratory session, etc.). Even if there is no universal agreement on language pedagogy, there seems to be widespread agreement on fundamentals such as holding the attention of learners, allowing repetition, and aiming for a range of practical exercise. But see Larsen-Freeman & Long (1991) for more on the range of (conflicting) ideas current in language pedagogy. Under the circumstances it is wise for CALL developers not to embrace any theory too exclusively, but to remain consonant with different approaches (cf. Lantolf 1996).

This introduction is not the place to rehearse the arguments that CALL is already making contributions to language pedagogy. It is cheaper, more widely available, and easier to schedule than human instructors, and more reliable, more interactive and easier to maintain and update than its competitors in print and the various sound media. But our focus is more specific.

## 2 State of the Art

In an effort to clarify where CALL has been successful and where CALL based on language technology might be best deployed, it behooves us as editors to say how non-language technology has made or is beginning to make its impact. We note the following areas.

**Exploratory/investigative learning** Student-centred methods are gradually finding their way into courseware, replacing or supplementing traditional teacher-based approaches. Linguistic and pragmatic knowledge is enhanced by exploratory (or investigative) learning based on hypothesis testing and problem solving.

**Authentic materials** Given the right type of motivation, participation in the target community is a primary objective of language learning. In contrast to what was traditionally assumed (the language traditionally presented to the learner was felt to need simplification for easy acquisition; cf. Widdowson (1990)), nowadays "authentic" materials from the community are regarded as a prerequisite for meaningful learning. Of course, these materials must also be presented in realistic contexts to retain their authenticity.

**Communication** Acquisition thrives on communication. Establishing contact with members of the target community is therefore of the essence for any language learner.

**Feedback** Feedback is essential to the teacher, the learner, and to classroom discourse (e.g., teacher's evaluative comments). It is indispensable to adult and analytic learners who wish to test their "hypotheses" with native speakers or other authentic sources.

**Individualization** The shift away from teacher-directed to student-centered learning is largely motivated by the need to cater to learner differences.

> Language learners may differ according to learning needs, aptitude, age, motivation, and cognitive styles. This calls for a high degree of individualization in the language learning process.

It is easy to see how each of these factors has contributed to promoting the use in CALL of the non-language technologies listed above. Hypertext constitutes an excellent means of accommodating exploratory learning and getting access to authentic language materials. Digital audio and video can be used to present contextualized, spoken samples from the target community, allowing for richer interaction than their counterparts on tape (play and/or record with synchronized textual support, branching, fast play back, etc.). Email, video conferencing and chatting may serve to give learners "access to real audiences, with authentic needs for information and authentic reactions to the quality of the communication that takes place" (Hoffman 1996, p.55). And database engines are useful devices for serving up practice materials geared to individual needs and keeping track of individual achievement.

At the same time one may ask the question why language technology has not so far been effectively deployed in the pedagogic areas outlined above. After all speech recognition is applicable in vocabulary training, where it could be used to provide a link between the written and the spoken representation of objects. It might also be applicable in more challenging, scenario-based activities and pronunciation support. Lemmatization might be used in support of reading skills and dictionary-based activities, including translation. Parsing might be feasible in restricted linguistic domains, etc..

## 3 Questions and (Attempts at) Answers

Our call for papers therefore specifically asked for reports on work that sought to match language technology to educational needs. That the conference title suggested an emphasis on teaching rather than learning may come from the organizers' positions at a university. This emphasis is also justified by the relatively small size of the self-instruction market (but see below on the significance of alternative education). We thus arrive at the need to convince language teachers of the value of CALL—surely a prerequisite if CALL is to be used widely. We suggested that language teachers might find flexible, customizable CALL packages most attractive, and we further speculated that there were opportunities to automate tedious language-learning tasks in the spirit of CAI for mathematics, providing value to language learning beyond drill and record-keeping.

Alternative, but less focused fora clearly exist for the work presented here: the focus falls within the subject matter of CALL, which has a yearly conference, CALICO,[3] as well as an annual European event, EUROCALL.[4] But these

[3]See `http://calico.org/`
[4]See `http://www.hull.ac.uk/cti/eurocall.htm`

general conferences cover all aspects of CALL, and the time seemed propitious for an event focused on the deployment of language technology.

The following is a list of questions asked in the original call for papers, together with references to contributions in this volume addressing the questions.

1. How can language technology (speech recognition/synthesis, morphological and syntactic parsing/generation, semantic classification) be further harnessed in support of language learning?
   See Allodi, Dokter and Kuipers on World-Wide Web "brokers"; Carson-Berndsen on speech synthesis; Dokter and Nerbonne and also Roosmaa and Prószéky on lemmatization and indexation; Murphy, Krüger and Grieszl on parsing and error recognition; Rothenberg on speech recognition and the Web; Skrelin and Volskaya on speech synthesis; van Heuven on parsing and pattern matching; Witt and Young on speech recognition; and Yablonsky on morphological generation.
2. How good is CALL compared to language learning without benefit of computer assistance? Can one measure improvements, and do these involve speed, proficiency or enthusiasm of CALL students?
   See Dokter et al. evaluating a program using lemmatization; McCreesh on grammar exercises; Hamilton on grammar and error recognition; and Giardini and Vergaro on mixing a palette of CALL aids from a range of offerings.
3. Is computer-assisted learning always computer-assisted instruction? Is nearly all language-learning done under instruction? What are the opportunities for long-distance learning?
   See Holliday on the language of Email and its fitness as an an English writing model; Rothenberg on a mix of (mostly) individualized instruction with some human aid available; and Allodi, Dokter and Kuipers on tapping available Web resources.
4. What are the pedagogical consequences of exploiting this technology? Are there mixed and/or partial options? What are the results of large- scale use of CALL in language education programs? When can it be effective?
   See Borchardt on pedagogical (and other) thresholds; Hamilton on maintaining learner interest; Hendricks on Brigham Young's two decades of extensive experimentation and use; and Jager on involving language teachers extensively in CALL development.
5. How may results of Corpus Linguistics be incorporated into CALL?
   See Barlow on concordancing tools; Hu, Hopkins and Phinney on identifying learner errors (dependent on mother tongue); and Paskaleva and Mihov on aligning bilingual texts.
6. Are the different subfields of language instruction differently amenable to computer assistance–viz., reading, writing, speaking, listening, testing, translation?
   See de Vos and Hacquebord on testing; Dokter et al. and Roosmaa and

Prószéky on reading; Carson-Berndsen on pronunciation; Hu, Hopkins and Phinney on writing; and Jager on grammar.

In addition two contributions addressed an area we had not specifically noted: the more carefully modeling of learner knowledge and behavior that the computer venue affords. These were the paper by Düntsch and Gediga on modeling the acquisition of skills and the paper by Díaz de Ilarraza, Maritxalar and Oronoz on modeling the notion "interlanguage" for Spanish students learning Basque!

We also asked for contributions reporting on the marketing of CALL products, but we received only one presentation on this (van der Ven), which is not being published here.

## 4 The Groningen Perspective

As always there was varied individual motivation sustaining the efforts of participants and organizers, and of course there's no purpose in attempting to be comprehensive on this point. But some of the local issues vis-à-vis CALL are undoubtedly general. For this reason we wish to discuss them here. Some of these issues are:

- who is and should be involved in CALL?
- what is the most promising development path now for CALL implementers and users?
- what are the most bothersome hurdles to the successful deployment of CALL?

Let's begin with the 'who?' question: while the conference focus on language technology and language teaching included teachers and developers, arguably the most important players on the CALL field, it just as clearly omitted others, in particular language learners—the end users. Of course this is a difficult group from whom to seek direct representation, since it is not employed in a single industry or organized into a professional society. But language pedagogy experts (often known overgenerally as "applied linguists") should be a valuable source of information on how language is most efficiently learned. Fortunately, this group was represented at LT&LT, and it clearly has an important role to play in the future of CALL.

Language learners are furthermore not concentrated exclusively in formal education. Two other important markets are individual language tutoring (self-study), and language instruction offered by private industry. These have already grown into substantial markets[5] and developers active on these markets attended the conference and participated actively. See the forum discussion below (§ 5.2).

The issue of how best to develop, introduce and optimally exploit CALL is naturally the most important and simultaneously the most difficult. Our

[5] See RECALL marketing study, Fox (1996)

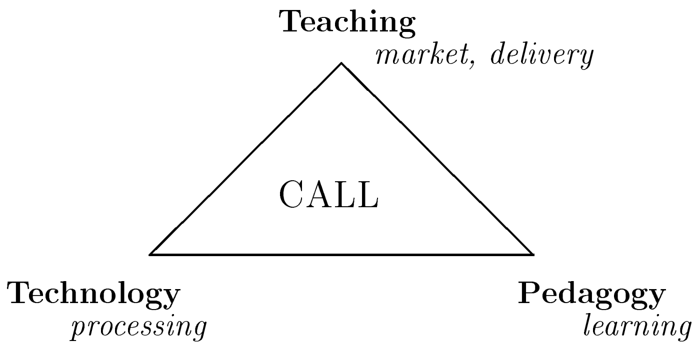


FIGURE 1 CALL properly involves input from language processing, pedagogy and teaching. The decision-making role properly belongs to the teachers, who are best capable of deploying the results of technology and pedagogy to their own (an their students') advantage.

position in Groningen proceeds from our responsibility as a formal educational institute, committed to providing high-level language training primarily to university students. This rules out a concentration on the alternative markets above—however interesting they may be immediately, and underscores the need to work with, rather than compete against, the language instructor. The particular advantage of the university as a CALL developer lies in the unusual confluence of expertise found here—in language instruction, in language pedagogy and in language technology. The exploitation of this coincidence of expertises naturally requires people interested in understanding and working across the boundaries of the narrow disciplines. Language teaching is a co-operative venture. This poses a challenge, but one which can be met. It will be met by developers knowledgeable about what is technically feasible consulting with applied linguists who know what is pedagogically sound, and collaborating with language teachers striving to exploit fully the language ambience of the university. Fig. 1 symbolizes our view of the component expertises needed in CALL.

The identification of important barriers is a favorite pastime among CALL aficionados, the obstacles including exaggerated claims (and subsequent disappointments), insufficient infrastructure, competition with a staff who feels threatened by CALL, need for staff training, poor fit with other materials, and complex decision and purchasing structures. We refrain from developing these points beyond this list of simple reminders (but Salaberry (1996), discussed above, is a good summary). The obstacles are genuine, and worth repeating in this general discussion, but they have received substantial comment elsewhere.

We remain confident that the long-term advantages are substantial enough for all concerned that CALL will continuing growing. The prospect of more extensive exploitation of language technology may accelerate the recognition of CALL's usefulness.

## 5 Conference

The conference was attended by 120 participants from seventeen countries. While most were university employees, about 10% represented companies involved in CALL.

Prof. Wim Liebrands, director of ECCOO, the University of Groningen's Center of Expertise for Computer-Aided Instruction, opened the meeting with a brief, sobering history of premature claims about how technology would revolutionize education—from film and phonograph to television and videodisc. His address culminated in a recommendation that CALL developments (and CAI developments in general) be judged by the fruits they bear: the extent to which they convince language educators, the extent to which they are used, the extent to which they are successful in improving or supplementing existing education.

His warning was echoed several times during the conference, especially by language teachers involved with CALL. Perhaps the strongest dissenting voice was Martin Rothenberg's, who reminded the plenary closing session that new technologies really do supplant older ones, using first the example of word processors supplanting typewriters, and also recalling the importance of grammar books and sound recordings in language instructions—the technologies of an earlier age.

### 5.1 Unpublished Presentations

The conference benefited immensely from three invited presentations which could not be included in this volume.

**Stephen Heppell** in a sparkling address pointed to the potential role of technology in coping with learner differences such as age, learner styles, and cultural diversity.

**Lauri Karttunen, Rank Xerox** spoke on the technological horizon, in particular, the progress that has been made on Finite-State Techniques, which are standard in morphological analysis, and are finding increasing deployment in syntactical recognition and analysis tasks such as idiom recognition.

**Joke van de Ven, Wolters-Noordhoff** reported on the success of *Cum Laude*, a product launched by Wolters-Noordhoff to prepare Dutch high-school students for a standard, nationally administered examination in English. She reported that 60% of examinees in 1966 purchased the product.

This book would undoubtedly have improved if we could have included more of these presentations, as well as more of the following contributed presentations:

**Jared Bernstein** presented work on speech recognition and pronunciation for English instruction for Japanese;

**Lise Desmarais and Michel Laurier** reported on evaluating learning in a multimedia environment;

**Lidwien Heerkens and Petra Heck** reported on TUMULT, a multimedia program for listening comprehension;

**Thierry Selva** reported work on an intelligent dictionary of French;

**Uta Weiss** sketched research on hypertext and reading

### 5.2 Forum Discussion

As a closing session, there was a plenary forum discussion on the future of CALL. Five discussants commented on the following thesis:

> CALL technology is mature enough to allow significantly improved language learning and teaching.
> The important difficulties have less to do with engineering than with organization and "marketing"– i.e., matching the technology to a population of appropriate users for whom sufficient compensation is available.

The following were invited to discuss the future of CALL using the thesis above as focus.

- Frank Borchardt, President of CALICO
- Graham Chesters, Director, TELL Consortium
- Arthur van Essen, Professor of Language Pedagogy
- Peter Isackson, CEO, Confluence Multimedia Publishing
- Martin Rothenberg, CEO, Syracuse Language Systems

It would be difficult, and probably presumptuous, to try to summarize the contributions of the speakers, who in any case did not have the time for careful, balanced and well-weighed presentation. We restrict our remarks here therefore to selected comments. Borchardt reminded the audience of the need to assess technical advance critically, Chesters reported that the TELL consortium was emphatically customer-, i.e. instructor-oriented, van Essen was critical of the educational bureaucracy, Isackson called for a down-to-earth attitude toward technology, and Rothenberg was alone in suggesting that CALL may already be revolutionizing how languages are being learned. The discussants were wildly successful in stimulating audience response, and the debate went on past the scheduled 75 minutes.

## 6 Prospects

One of our keynote speakers, Frank Borchardt, reflected on his decades of experience language teaching in applauding the demise of certain "gatekeepers", jealous of the turf they guard—whether it be technical, administrative, or educational (Borchardt 1997). He also warned that the struggle was far from over. It would be foolish to ignore his and others' words of caution about the difficulty in realizing the promise of CALL, but perhaps equally wrong-headed not to join in him in seeing the new possibilities on the horizon.

## 7 Acknowledgements

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