Technology in the Service of Language Learning: Trends and Issues

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THIS PAPER HAS TWO PURPOSES: FIRST, IT provides an overview, for teachers making little or no use of technology, of the kinds of technological resources currently available to support language learning and of various approaches to making use of them. Only brief mention is made of the promise of future hardware; technology that can be taken for granted today is already light-years ahead of the profession’s ability to integrate a principled use of it into the classroom and the curriculum. Not a review or evaluation of specific materials, it explores rather the pedagogical and research possibilities made available by technological developments of the past decade. The Appendix contains a bibliography of books and periodicals and lists of 1) organizations through which teachers can find out more on these topics; 2) publishers and distributors of software, video and audio; and 3) selected software programs available from the major foreign language publishers. An asterisk in the text of the article itself refers the reader to the Appendix.

Second, this paper explores some of the issues which surround the trend. The most obvious and immediate, of course, is the issue of efficacy: does using technology actually aid language teaching and/or learning? Is it worth the time, effort, and cost? But a number of other issues have as yet hardly been explored or even generally articulated: 1) should the technology be thought of as primarily assisting teaching (for example, handling homework, thus saving classroom time for communicative activities) or as directly supporting learning (for example, allowing students to explore cultural material as they like)? 2) 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? 3) should students work with pedagogically shaped materials or directly with authentic data? 4) should students’ access to the material be directed or entirely under their own control? What cognitive strategies or problems are implied either way? 5) what kinds of research does the use of technology for language learning demand or enable?

These issues have no “correct” or simple answers; in some cases we have no answers at all, but the questions are still necessary. Because the question of the efficacy of the technology can interfere with an objective assessment of what is available, it will be considered first.

EFFICACY

Can using the computer actually help students learn another language? More pointedly, can it help them learn to communicate in another language? Concerned teachers want research reports to give them simple answers, but studies published so far (for an overview on this research see 11) are either inconclusive or flawed enough in their methodology so that claims continue to be asserted both ways. The real problem is that
so general a question can probably not be researched with validity without first identifying and researching all of its individual, even microscopic, components. First, research studies in the past several decades comparing foreign language teaching methods have proven inconclusive, and we have good reason to believe that studies evaluating the efficacy of technology-as-method will inevitably be flawed by many uncontrollable variables (1–2; 4–6). It is impossible to design a large-scale and comprehensive study which would be both valid and feasible comparing the language learning of one randomly chosen group of students who use the computer to the learning of others who do not. Unfortunately, the question “Does it work?” is simply not answerable on such a broad scale.

Second, and more important, a methodological approach is inappropriate because the use of the computer does not constitute a method. The computer is rather a medium or an environment in which a wide variety of methods, approaches, or pedagogical philosophies may be implemented. Computer materials could be designed to carry out a grammar-translation syllabus, or audio-lingual drills, or cognitive analysis of language, or a good deal of the kind of learning activities that make up a communicative syllabus. Studies comparing computer-assisted with non-computer-assisted learning per se are therefore no more helpful than would be studies comparing textbook-assisted with non-textbook-assisted learning. Instead, we need to break down the issue into a set of queries about interrelated and complex research variables: what kind of software, integrated how into what kind of syllabus, at what level of language learning, for what kind of language learners, is likely to be effective for what specific learning purposes? The research agenda suggested by those questions cannot even be undertaken until we have many kinds of software, have integrated its use according to different principles into a variety of syllabi at a range of levels, etc. In fact, we are not yet generally agreed either on the parameters by which to frame the research hypotheses or on the measures by which we can establish the results. It is therefore clearly unreasonable for the profession as a whole to demand proof of how the computer works before allowing itself to become interested. We have to begin with the use of the computer as a method.

WHAT IS AVAILABLE? WHAT CAN BE DONE WITH IT?

Discussion of technical details and specifications in this section will be brief, because hardware makes, models, and prices change constantly. Teachers or schools ready to purchase hardware or software will need to discuss their particular needs with vendors who can supply immediate details. This section will focus on the newer technologies less familiar to foreign language teachers and suggest ways of integrating their use into language learning. “Conventional” audio technology, that of the tape and the language lab, needs no explanation here. Newer audio labs (SONY, for example) are based on delivery of digitized sound, but, although this improves the sound, it does not change the use to which audio work is usually put or the way it affects learning. Sources of audio material are well known and easily accessible to teachers (although the shortwave radio is often overlooked), and the machinery involved is not generally regarded as threatening. (The use of audio devices under the control of a computer will be dealt with in the section on interactive technologies.)

Video. The use of videotape is by now also widely familiar to language teachers, and rapidly increasing numbers of schools own videotape players for use by teachers in many fields. Playing a videotape in class is much less trouble than the “old-fashioned” equivalent of showing a 16mm movie on a projector, and visual materials of excellent quality in their own setting should not be overlooked. With the advent of lightweight cameras able to use natural light, teachers and students can now produce video materials of excellent quality in their own setting for a variety of purposes. Almost all language teachers take advantage of students’ enthusiasm for putting on skits (their own or from literature) or performing plays or songs; video recordings of these performances can make them available for use with other classes, for discussion or
analysis, or for comparison with later performances to show language progress. Native speakers on campus are often delighted to participate; they can model all kinds of communicative interactions to demonstrate gesture, facial expression, and stance, all of which provide important paralinguistic information on which listening comprehension is based. At the University of Illinois the French department taped a series of very short segments demonstrating greeting behaviors in a range of social situations—between a man and a woman who know each other slightly, between two men or two women who are long-time friends, between an older person and a younger, in formal and informal introductions, etc. Another series showed a male student trying to strike up a conversation with a female student in hopes of arranging a movie date; variations included his being shy or pushy, the female being willing or stand-offish. The crucial factor in assuring authentic and natural behavior, both linguistic and paralinguistic, is making the performances as spontaneous as possible. It is extremely difficult to create scripts without the flavor of textbook dialogue, and it is almost impossible for students, even native speakers, to deliver memorized lines with authentic-sounding spontaneity. If native speakers "rehearse" by talking through the situation, the emotional interactions, and the kind of relationship to be enacted and then simply act it out in the language that comes naturally to them, the results are astonishingly realistic and of far greater use to students than all but the most expensive professional productions.

Videotaping of actual classes can serve pedagogical purposes. Teachers are for good reason unwilling to interrupt the substantive and intense discussions or debates often generated in advanced level conversation classes, but students can learn much from careful analysis of the discourse and interactions; videotaping allows that analysis to be carried on the next day. Methodology students preparing for teaching careers can be taped during practice teaching sessions for later criticism.

Scholars in any discipline or performers from foreign countries in residence for a term or coming to campus for a particular occasion are often willing to be taped giving presentations in their native language or a (possibly somewhat simplified) discussion of their subject in their own language so that language programs could gradually build up a library of poetry readings, lectures, song recitals, interviews, etc. Another potential source of highly authentic and enjoyable videotapes is a classroom of students in a target language country; many schools in Europe and Japan are now also well equipped with video. Just as student pen-pals have for years exchanged letters, classes and schools can now exchange videotapes. Since foreign video uses different technology, one needs playback equipment specifically designed for the appropriate standard, but tri-standard players are available.∗

Perhaps the most exciting source of foreign language video is satellite transmission of "authentic" video, target language programs produced by and for native speakers in their own country rather than for pedagogical purposes. Many schools and universities now have dish antennas which enable them to receive satellite video. Copyright laws prohibit making permanent videotape copies of broadcast materials, but teachers can record video transmissions for "fair use" in classes, generally for up to ten days. The limits on fair use of live video must be carefully observed, because the penalties for copyright infringement are severe and the willingness of broadcasters to transmit these materials is eroded by their lack of confidence in the professional ethics of recipients.

SCOLA∗ (Satellite Communications for Learning Worldwide) is an organization of schools interested in the use of satellite technology for enhancing education in many different institutional contexts. It receives video broadcasts from around the world and rebroadcasts them for reception by member institutions for use in their classes and by individual students. Membership costs are calculated on the basis of student enrollment, so they vary widely across institutions. The NY Network at SUNY-Albany∗ is pursuing plans for a Soviet TV satellite service, which would broadcast an hour of live Soviet TV per day to subscribing institutions.

The extent to which authentic video can be genuinely integrated into a language course (as opposed to being merely brought in as an amusing extra to fill time) depends on teachers’ ability to gauge the comprehensibility of the language content and the intrinsic interest of the material for their classes. Preparation of adequate support materials is extremely time consuming, but without glosses, notes, comprehension questions, etc., for students to use either before viewing the video or in doing assignments on it, substantive discussions and classroom activities are unlikely. Without these efforts, the most authentic linguistic and cultural material in the world is likely to be regarded passively by the students, not integrated into learning, and to be of little long-term value.

Several major projects now make available foreign video in various forms accompanied by such activities. France-TV Magazine∗ broadcasts video
produced in France through a special subscription service on PBS; faculty members from the University of Maryland and nearby high schools produce a wide variety of instructional materials to accompany each broadcast. A companion program in German began in January of last year.

The PICS* project (Project for International Communication Studies) at the University of Iowa was developed as a solution to a number of the problems encountered in making use of authentic video. Ongoing connections with major video producers in Europe have been established, through which the project receives significant amounts of video materials created for regular broadcasting in the country of origin, together with copyright permission to make these materials available to language teachers in this country in a variety of forms. Video modules of all kinds in French, German, and Spanish are created on both videotape and videodisk, and PICS project staff works with interested faculty at other institutions to prepare ancillary materials (such as glossaries, scripts, computer exercises) at appropriate pedagogical levels. These video selections of news, entertainment, advertising, and documentaries provide an extremely rich source of culturally meaningful material which can become a permanent part of a foreign language program.

Videodisks are often regarded as useful only in connection with a computer, but in fact videodisk players can also be controlled with a “paddle,” a hand-held control device for accessing the frame desired. Delivery systems for videodisk need not therefore be very expensive. A videodisk is an iridescent metal or metallicized plastic disk about twelve inches across which can hold thirty minutes per side of video plus two audio tracks of thirty minutes each, or approximately 52,000 slides; any specified slide or frame or video segment can be accessed instantaneously. Many videodisks created for language learning purposes use the second audio track for a simplified target language (or English) version of the target language soundtrack that accompanies the video. (The contents of a videodisk cannot be altered or added to after it has been pressed, so teachers cannot decide for themselves what they would like to have on the second track.)

Attitudes Toward Audio/Video and Computers. The contrast in teachers’ attitudes toward audio and video on the one hand and computers on the other is striking. Audio has been with us for decades, and although language lab technology is certainly more sophisticated now, the general concept of delivering audio enhancement to standard text materials is familiar. Many students own their own portable cassette players, to the extent that some colleges and universities faced with obsolete audio labs (Smith College and Brown University, for example) have opted not to replace them but have instead established systems whereby students borrow or buy the standard language tapes to play on their own equipment; students who do not own them may borrow tape players as well. On the other hand, other institutions (the University of Illinois, for example) report a resurgence of interest in audio lab use, especially for less commonly taught languages. Videotape players, too, are already so widely owned, not only in schools but also by the general public, that the machinery is not regarded as particularly intimidating. Video in a foreign language is intuitively appealing to language teachers and students alike (much more so than audio), and there is very little controversy about its value, although there is little hard research on its use. Teachers may not always use audio and video with maximum efficiency or imagination, but they may use them without anxiety.

Computers, by contrast, cannot yet be taken for granted in every school or every household; they are much more expensive and have an elitist aura, and to most teachers the idea of programming is daunting. As the following discussion should make clear, however, much of the anxiety is unnecessary, since teachers do not need to be able to program in order to be able to tailor or even create software suitable for their own students’ use.

Computers. Touching briefly on the issue of hardware choice, publishers of FL software agree that the Apple II series of computers still dominates the secondary schools, and the largest segment of commercially available software is written for them. Most FL software available for the Apple IIs consists of drill and practice in elementary grammar and vocabulary. This simplicity is due partly to machine limitations and partly to the early stage of instructional design at which it was conceived. Computer-assisted education is still in its infancy and, like all infants, grows quickly and beyond all recognition; it is hard for school administrators to accept that the expensive machinery bought only a few years ago is already obsolete, and they understandably feel that when the equipment must be replaced the new machines must at least run the school’s accumulated software. The Apple II GS was introduced to enable schools to run old Apple software on newer machines, but so far, apparently, little FL software has been written to take advantage of its expanded capabilities.2
software written for the older Apples is neither worth keeping nor worth using as an argument for compatible hardware upgrading; by today’s standards early programs allow only a fairly crude realization of the potential of CALL. Screen resolution is poor, so that accents and even letters may be difficult to see clearly; more serious, the pedagogical value of the programs is very limited. The 256K memory of the IIGS and the basic IBM-PC microcomputer (and its many clones) is now generally accepted as a minimum standard, and most IBM-compatible commercial FL software packages require only 256K to run. Publishers often bring out simultaneous versions of materials for a variety of machines, but teachers must still be careful about accepting at face value claims about compatibility; not every lesson programmed for the IBM-PC will run smoothly on every PC clone, or vice versa.

Discussions with publishers, with FL faculty at CALICO* (Computer Assisted Language Instruction Consortium) meetings, and with academic computing staff who convene at EDUCOM* indicate that in colleges and universities, computer facilities for language departments (or the humanities generally) tend to be equipped with IBM or compatible machines or with the Apple Macintosh (which is not compatible either with the Apple II series or with IBM-type machines) or with both. Smaller institutions have sometimes elected to buy and support only one type; Smith College, for example, formerly supported only IBM-type machines for students, while Bryn Mawr supported student purchase and use only of the Macintosh. However, both these institutions, like most larger ones, have found it necessary to support a variety of machines, even though that support—maintaining the hardware and the facilities, acquiring support software, training people to help and instruct inexperienced users—requires serious and expensive institutional commitment. IBM, Apple, and AT&T have all made major gifts of equipment to many campuses and have established ongoing grant programs to fund the development of educational software as the best way to sell more of their hardware. IBM, for example, instituted its Advanced Education Projects program in 1985 with hardware gifts to nineteen major campuses (including the Ivy League schools and a number of state universities including Illinois, Minnesota, Wisconsin, Texas, Washington, and North Carolina, among others), and the software created in the course of these projects is widely available, sometimes in pilot form, through a distribution system called WISC-WARE* (see also p. 98). Apple began in 1988 to encourage institutional applications to its “Apple Seedlings” project for gifts of Macintosh equipment for educational software development; AT&T has also issued invitations at some campuses for research and development proposals.

Those who need to decide on major hardware purchases are usually advised to consider first the software they want to run and buy the machines that run it. In general that is good advice, but in education (perhaps especially in language education) the existing software does not yet adequately represent the capabilities of the current hardware. (Some teachers, after examining the software, decide against purchasing any hardware.) At this stage of CALL, the best decisions are likely to be made by language teachers who have: 1) considerable classroom teaching experience; 2) broad familiarity with available software and with current pedagogical uses of it in other language programs; and 3) access to up-to-date technical information about hardware. Obviously few teachers can as yet lay claim to that combined expertise, but the International Association of Language Learning Labs (IALL)* has a list of consultants, and some major language laboratories have enough experience with computers in language teaching so that their staff members can field inquiries, although some universities’ humanities computing centers handle instructional computing, but many address the computing problems of the scholar and researcher, rather than those of the language teacher.

**Classroom Use vs. Lab Settings.** In most schools, of course, FL teachers do not have a major voice in deciding which hardware should be purchased. Neither, usually, do they have much say in establishing the configuration of computers on which they and/or their students will work; they may have access to one in the department office, or three in the back of the classroom, or ten in the library or media center for individual use, or twenty in a laboratory-classroom to which they may take their classes one period per week. What can they do under each of these circumstances?3

Even in the absence of a budget for student-use software, a single computer in an office can still be extremely helpful to teachers at any level in preparing handouts, particularly for less commonly taught languages or for students at age levels for which print materials are scarce or unsatisfactory. Most of the major word-processors can handle the special characters and accents of the commonly taught languages (see the Modern Language Journal 73.1, “Notes & News”), and several
allow text creation in an astonishing number of non-Roman alphabets (e.g., Multi-Lingual Scholar, Gamma Productions*). Of course, one needs not only the word-processing software but also an appropriately equipped printer.

Most experienced teachers develop over the years large files of dittoed exercises and quizzes, and they are nonetheless resigned to finding every year that last year’s version is not quite right. Data base software makes possible the compilation of infinitely révisable sets of items and questions, from which one can select and print out those appropriate to a particular occasion. Such a program can also be directed to select items at random to combine in a printout or to randomize the order of items, so that different quizzes can automatically be generated from the same set for those first period and fifth period classes.

Calculating grades is a chore for which the computer is ideally suited, and numerous gradebook programs are available which offer advantages well beyond those of a calculator. Not only is the computer immune to the fatigue that sets in the night before grades are due, but it also makes easy any interim calculations requested by borderline students or anxious parents. In many programs teachers can specify the weighting for each grade or average and develop their own formulas. (A review of grade-book programs for Apple II machines appeared in Foreign Language Annals [February 1990].)

Even a single computer can be used in the classroom with students; with the lesson visible on a large computer monitor or a computer screen projector, the teacher (or designated students in turn) can type in responses called out by the others. For example, some vocabulary or grammar drills, especially those programmed to seem like games, lend themselves to team competition activities in class. Other software packages present simulated problem situations or games, often with intriguing graphic effects, and such “lessons” can encourage lively discussions in the target language as students debate the appropriate input. (Tom Snyder Productions* specializes in such packages, although this author is not aware of any specifically designed for FL education as yet.) Finally, students can even learn grammar by analyzing and criticizing (under the teacher’s guidance) the way a computer lesson carries out error analysis and arrives at feedback messages.

Classrooms equipped with a small number of computers can provide a solution to a number of common language teaching problems. Students who need individual help with a particular problem or who must make up for an absence can do tutorials or homework assignments on the computers during study periods or after school with only intermittent attention from the teacher. In class, students who complete an activity early can be allowed to amuse themselves with game-format or problem-solving software apart from the others—but only with programs whose sound effects can be turned off! Class activities grouping three or four students around each computer can be based on such software; teachers who have tried this often comment on the surprising amount of target language discussion thus generated. (This use also answers the philosophical objection that language should be engaged in as an interaction between people, not between a person and a machine.) In secondary schools with small programs teachers are often required to teach two different language classes in the same room at the same time; the availability of computers can allow the teacher to engage in communicative activities with one group while the other is absorbed in writing, homework, problem-solving, or games.

The most common placing of computers at the postsecondary level is in a lab or media center to which students have independent access, rather than in a lab reserved for scheduled class use. (The latter arrangement is more common in secondary schools.) In some ways this configuration is easiest for teachers who prefer not to become directly involved with CALL themselves; they can assign homework to be done on the computer, without relating its use directly to classroom activities. However, the author would argue that the full benefits of CALL will not be realized until its use is fully integrated with classroom work on the basis of theoretically motivated research on the kinds of learning activities most enhanced by technology and those best undertaken without it. Using the computer for homework is probably the first implementation to occur to the technologically inexperienced teacher and is still the most common. Indeed, it is an altogether valid one; students can learn much more from software which gives accurate and individualized feedback than from workbook or textbook exercises corrected collectively in class or later by the teacher. Class time is then freed for more personal and communicative activities. However, using the computer only for grammar homework by no means exhausts the possibilities and should not be taken as its major use (see the discussion below of software designed for other kinds of learning).

Networks and File Servers. Some computer labs or media centers have local area networks (LANs), in which several microcomputers are linked so
that they can run the same program at the same time, and some software publishers offer special pricing for packages which will be so installed. One network strategy involves loading all software used in the lab onto a file server, which is one machine with much greater capacity than student workstations. Students with appropriate access codes can then work on their own, downloading the software they want to work on from the server to networked machines in the lab or even elsewhere on campus, but they cannot change or copy it. Some file servers allow a given package to be used only by one person at a time, which makes them unsuitable for classroom use or for lab situations in which several students may be doing homework simultaneously. Servers can also be extremely slow when data must be constantly read from and written to the hard disk. Teachers interested in setting up networks in their computer labs should research these problems carefully. Pricing strategies for networks vary widely and must be negotiated for each particular situation.

A full-fledged campus network also allows teachers and students to communicate with each other outside of class, and this then makes possible a variety of foreign-language-using activities. John Barson (Stanford) has developed a broad range of writing and communication activities for his students, and with Judith Frommer (Harvard) is now working out the cross-country publication of a student newspaper in French. Karen Smith (University of Arizona) uses “conferencing” techniques on the university VAX (mainframe) system as the medium for students’ interpersonal correspondence in Spanish.

The Computer Alone or Linked to Other Technologies. Some teachers and materials developers have become so enamored of video that they see the computer by itself as a sterile and in-authentic environment for language learning. No downplaying of the importance of video need be implied by an insistence on the equal importance of the computer itself in language learning and teaching. Even though it cannot present spontaneous oral interpersonal communication in its full cultural context, that is not the only form of language of interest to language teachers or indeed to many language learners. Text-based activities, reading and writing, are integral to virtually every language course beyond its first beginnings. Some applications of technology that go beyond the elementary-level concern with grammar and vocabulary are explored below; suffice it here to insist that although the addition of audio and video capabilities to the computer make it a rich environment for learning, the computer in its own right should not be dismissed as unimportant. Another major reason for continuing efforts to improve computer lesson design is its central function in organizing and controlling interactive audio and video configurations: the most authentic and expensively produced audio and video materials will still make for mediocre language lessons if the computer program which presents them is poorly designed.

COMPUTER-MEDIATED TECHNOLOGIES

The multiple advantages of presenting students with authentic oral language and the visual/cultural context for communication are so obvious that few language teachers can see demonstrations of interactive audio and video without feeling that these technologies must have enormous beneficial impact on students’ acquisition of communicative proficiency. As yet few institutions have the facilities for presenting students with a large-scale, fully interactive language learning environment, but because of significant advances in this area teachers should be introduced to its potential.

The term “interactive” is used with two rather different meanings in discussions of technology-based language learning. In the phrases “interactive audio” and “interactive video” the word refers to the interaction between the two devices, the machine which delivers the sound or picture and the computer which controls that machine and may also deliver textual material, on its screen, to accompany or alternately with the audio or video presentation. When used as an adjective for a program or a lesson (as in “a highly interactive lesson”), however, it tends to refer to the degree of interactiveness between the student user and the computer. (In this sense it can be used whether or not audio or video are part of the configuration.) In neither use should we take it for granted that “very interactive” is automatically better than “not very interactive.” A high degree of interaction between the computer and another device may still be slow and crude; a high degree of interaction between student and computer may mean only that the student keeps pressing the Enter key; it does not guarantee a complex and challenging relationship between the student’s input and the computer’s response.

Interactive Audio. Interactive audio can be achieved via several different technologies.
Computers can be equipped to operate tape recorders, and if: 1) the computer lesson is strongly linear in design and; 2) the tape material is carefully sequenced so that little rewinding is required, this configuration can be quite efficient and is likely to be perceived by students as more interesting and of more assistance to learning than is audio by itself. Nonetheless, access to the audio segments cannot be as fast as one would like and, over time, with even slight stretching of the tape, the accuracy with which the computer controls the access to the desired segment can deteriorate.

The technical research on speech synthesis (a process whereby the computer itself reads code and converts it into electronic sound) is already well advanced but not yet at a stage where it can reliably render a target language accent authentic enough for language teaching. The “random-access” audio device was developed to solve this problem: a fourteen-inch disk of the same material as audiotape, which can hold thirty minutes of recorded material, is “read” by a computer-controlled head. (The sound is produced by real people and recorded just as in a traditional tape recording; this is “analogue” sound, not synthesized.) Any desired bit of sound can be accessed in about one-fourth of a second, so that students can branch as they like through a computer lesson and always have access to the accompanying sound segments. They can record their own voices on a separate track of the disk for comparison with the recorded voice; each student’s recording disappears from the disk when the computer turns off. Mastering the audio disks from tape can be done in-house, and disks can be re-recorded, errors corrected, etc., although it is tedious. Unfortunately, random-access audio disk players are expensive (currently about $2,000 each) and have not been widely purchased, nor have many language course materials been developed for them, except at the University of Illinois, where it has been in use with the PLATO system for many years and has also been used with the IBM-PC in materials development projects in Swahili, Wolof, and Korean. This technology is probably already obsolete in light of recent work in sound digitization.

Digitization, the same process which records music on compact disks for home stereo sets, is occasioning great excitement in educational audio technology. The analogue signal of a voice recording (or music) is converted into a digital code, which is read by the computer and reconverted into sound. The latest generation of computers has as standard equipment speakers which commonly produce a variety of sounds to accompany lessons (musical tones, beeps, buzzes), and these speakers can also deliver digitized speech (created on a special recording device and stored on a disk or in computer memory) with extremely good fidelity and as good an accent as the person recording. The recorders which interface with the Macintosh (for example, the MacRecorder) are small, easy to use, and inexpensive, and authoring systems such as HyperCard (see section on Authoring below) make the integration of sound into the computer lesson very easy. IBM machines need a special card to carry out the signal conversion; at the moment that technology is less friendly than that of the Macintosh but is capable of better quality sound. Given the high degree of interest in this area and the intense competition among hardware manufacturers, the audio situation can be expected to change rapidly. The serious hindrance to large-scale development of interactive audio materials via digitized sound is, at present, the disk space consumed by sound; to add much spoken material to computer drills (for example, sentences using words in context) would require every user’s machine to have a hard disk. Intensive work is already underway to develop better techniques for compressing the digitized sound signal, but beyond a certain point the compression degrades the signal to the point where the accuracy of the phonetic representation is unacceptable. Not until the technology for large memory storage becomes very cheap (for example, until microcomputers are regularly equipped with hard disks of twenty megabytes or more) or techniques for sound compression are greatly improved can we expect rapid development of interactive audio language materials. CD-ROM (Compact Disk Read-Only Memory) allows the storage of astonishing amounts of text data on a single CD, but again, the audio capability is much more limited, and the data cannot be freely manipulated. We must choose the technology to fit the task: to expose students to large amounts of natural language audio input, we need tape, but digitized sound controlled by the computer can provide a valuable way of working intensively with selected audio segments. Moreover, a few minutes of audio can be the basis for hours of lesson materials.

**Interactive Video.** Interactive video, too, can be achieved via tape; computers can control the winding and rewinding. Again, if the materials are well planned, the delays need not be perceived as too intrusive. Tape use is likely to continue to be important even when videodisk technology becomes cheaper and more widely accessible, because it makes possible the integration of
up-to-the-minute video materials into lessons; with the aid of a simple authoring system and a standard format for computer-controlled vocabulary help, cultural notes, and comprehension questions, a tape of today’s satellite-broadcast news can be plugged into next week’s interactive listening comprehension lesson. The tape can then be reused for the next lesson. In contrast, creating a videodisk takes months and results in permanent material, which is illegal unless copyright permission has been previously obtained.

Nonetheless, for most language teachers interactive video implies the use of videodisk under the control of a computer. At the same time, of course, one can provide computer-based textual material of all kinds to alternate with the video on the computer screen as desired. Students could be given access to a transcript of the scene; help with vocabulary, idioms, grammar, or even a translation; cultural notes; or comprehension questions, as well as options for replaying certain segments. (Remember that the pedagogical value or interest of the lesson may be quite independent of the quality of the video material and of the smoothness of the technological interaction.)

Videodisks are not yet widely available, but they can be expected to appear fairly rapidly. Producing a videotape to be pressed on a disk demands near-professional expertise, and the disk itself must be produced commercially; once pressed, it cannot be altered. Creating a trial copy costs about $300; a master disk for mass production costs about $1,800. After that, however, individual disks made from the master may cost as little as $25, depending on the size of the order. Once the developers have geared up, therefore, and once videodisk players are common property, a great deal of exciting material should be available at relatively low cost.

SOFTWARE

Preview and Purchase Agreements. All the above-mentioned possibilities for using computers depend, of course, on the availability of the appropriate software, and a discussion of that problem alone could fill many pages. A regular perusal of publishers’ catalogues is necessary to keep abreast of rapidly changing offerings, and direct examination of packages is extremely desirable, since descriptions and claims, even when written by objective reviewers, may be confusing or opaque to those inexperienced in evaluating software. Teachers should request materials to be sent for thirty-day approval periods. Although some publishers prefer to send partial or demo versions for fear of illegal copying, inexperienced evaluators may find it difficult to tell from a demo exactly how the software really functions. No teacher should engage in or allow students to engage in illegal software copying. Not only is doing so a criminal act, but it is against our own professional interests: in the long run; software piracy guarantees that publishers will be unwilling to invest in the development of top-quality software.

Publishers often offer software for multiple-student use, whether or not a network is involved, under a variety of agreements which reduce the purchase price considerably. A site license price is based on the number of computers on which the package will be running or sometimes on the number of students in the courses for which it will be used. Teachers who are interested in a type of purchase agreement not listed with a given package’s price should try to negotiate one with the publisher.

General Categories of Software. Most commercial language software still focuses on drilling vocabulary and grammar at the first-year level (even most of the “games” are just drills with frills). The standard five-part categorization into tutorials, drills, games, simulations, and problem-solving is so widely discussed in the literature as to need no exploration here. True grammar tutorials—programs which introduce, fully explain, and practice a structure—are less well represented than drills, because software authors tend to assume that grammar is presented by the teacher or the text so that students need only a reminder to preface a drill. However, Dominguez’ Spanish MicroTutor (Harcourt Brace Jovanovich*), which won a Distinguished Software award from NCRIP-TAL/ EDUCOM* in 1989, and Clef (University of Western Ontario) are notable examples of this approach.

Textbook Accompaniments vs. Free-Standing Software. Many textbook publishers are now offering with their standard texts “electronic workbook” software, in some cases for a variety of machines, just as they offer audiotapes and regular workbooks. As discussed above, these represent the simplest implementation of the computer, and depending on the sophistication of the exercise format and the competence of the programming they may be quite worthwhile. Obviously, though, they have the good and bad features of the original exercises (and may in addition give seriously inadequate or misleading feedback which is
sometimes worse than none), and they certainly do not represent the full range of the technology’s capabilities. (See 11 for a review which examines a text-specific package in the context of a discussion of the advantages of these vs. free-standing packages.) Free-standing grammar or vocabulary software not developed in conjunction with a textbook may be published as single disks covering specific topics or in sets; some large sets address all the major grammar structures of a given language, to be used for review or reference purposes. A wide variety of the other categories can be found in free-standing packages.

**The Four Skills.** The “four skills” provide a familiar framework for examining the instructional potential of the available hardware and software (12). Speaking has had top priority in many programs for some time now, but the computer is far from ready to substitute for a human being in spontaneous authentic communication. Many other kinds of learning and practice may well help students lay the groundwork for speaking proficiency, but we do not yet have good research data on which ones or how they should be organized. Most teachers believe that a certain amount of structured work on grammar and vocabulary is necessary, so that “communicative practice” on the computer may contribute significantly if indirectly. Any activity which provokes thinking in the target language can be an important precursor to speaking. Moreover, the computer’s ability to provide the stimulus for inter-student target language discussion should not be overlooked.

Listening practice requires audio either on its own, in the context of video, or interfaced with the computer. Given the often dismal track record of self-contained audio in the past, many teachers are enthusiastic about the newer technologies’ ability to enrich listening activities. Video can provide the vivid communicative context; Wakefield (Minnesota) has developed videodisk-based listening comprehension materials in German. He argues convincingly that listening without a visual context is communicatively inauthentic (except on the telephone or radio) and unreasonably difficult for learners. The computer can provide textual support for listening (transcripts, glossary help, structural clues), which is particularly valuable at upper levels of language study where literacy and knowledge of formal language play a much greater role in comprehension.

Reading comprehension is the skill for which the computer is most obviously suited. It is also an area of pedagogical theory which has changed a great deal in the past decade, and teachers looking for computer-based reading comprehension materials should be aware of the quite different kinds of help that can be offered and the theoretical basis for the difference. Traditionally, reading comprehension has been seen as a kind of decoding, where the most important help is lexical, and programs designed from this perspective can be extremely sophisticated in the ways they allow students to call up literal, idiomatic, or contextually sensitive translation equivalents. However, recent theoretical work on reading has downplayed the value of lexical decoding and has focused on the wide variety of strategies employed by readers—skimming, scanning, inferring, predicting, etc. In programs designed from this perspective the computer can highlight the appropriate textual clues to these strategies or use automatic timing to pace a learner through a text for various purposes. In both kinds of lesson, comprehension questions can be designed so that computer feedback to an inadequate response is not just “yes” or “no” but a highlighting of the text segments on which it should have been based. Major projects developing authoring systems for reading comprehension materials development are underway at the University of Minnesota under the direction of Dale Lange (for the IBM), at the University of Iowa under the direction of Geoffrey Hope (for the Macintosh), and at the University of Western Ontario under Glyn Holmes.

The greatest value of a good software program for creating reading comprehension lessons is that it can allow the teacher to convert an attractive text into a “graded reader” with precisely the amount and kind of help needed by a particular class. This is particularly important for the less commonly taught languages, for which little commercial material is available. Reading lessons at several levels of difficulty can be prepared for the same text for use by both intermediate and advanced classes, with quite different help available to each. Favorite literary texts that are out of print or have never been published for the educational market, or current newspaper articles, can be fully supported. The authoring facility or editor of such a program should make it possible for teachers (or their assistants) to do little more than type in a text and specify the appropriate helps. Longer texts can be entered much more efficiently into the computer with an optical scanner, a device which resembles a copying machine but which translates the text it reads into computer characters which can then be edited or otherwise reworked with one’s own
Writing is from one perspective a natural activity for students to undertake on the computer; after all, it is the one activity for which a large number of teachers use a computer themselves. (Even faculty members who are opposed to using technology in teaching are often enthusiastic about word-processing.) In one sense any lesson which requires typing in the target language, even if it is only in grammar or vocabulary drills, is giving some practice in writing. A different component of the writing skill could be practiced in lessons which ask students to unscramble sentences or paragraphs or to translate from English (an activity frowned upon by many teachers, but still an extremely useful outside-of-class exercise). Wherever the desired output can be exactly specified as an anticipated response, the computer can respond to student writing, in as much detail as the lesson designer desires: the computer simply compares the student’s input with an internal representation of the correct answer. If it also has an internal representation of a set of anticipated wrong answers, the computer can be programmed to respond specifically to a variety of errors.

But software design and programming have not yet arrived at the point where a lesson can accurately judge every detail of a student’s spontaneously produced writing. Some word-processors now have spelling-checkers in the common languages, but some teachers have pedagogical objections, wondering how students will ever learn to spell, if all their mistakes can be found (and, in some word-processors, corrected) automatically. Although a great deal of extremely interesting work is being done at many universities (Carnegie Mellon, MIT, Illinois, Guelph) in the development of parsers (programs which can automatically analyze the grammar of a sentence), none of these is large scale enough or sophisticated enough to deal with more than a narrowly defined domain of language.

However, language educators are increasingly interested in using computers to teach writing in much the same way already being done in the teaching of English. Many universities have developed large-scale programs in English composition or rhetoric which are heavily computer-based (for example, Illinois and Carnegie Mellon). Students learn to use writers’ helper programs for developing their ideas and the structure of their compositions and word-processing packages for writing, revising, and editing them. The final version is then delivered to the instructor either on disk or printed out. The same kind of work can easily be imagined in a FL program with a word-processor and printer that can handle the requisite accents and special characters.

But supporting free writing in a foreign language requires different and much greater resources than in the native language. Though English composition software programs sometimes include a thesaurus, FL students have much greater need for lexical help, and students writing in their native language do not need references for basic morphology and syntax. One of the most interesting FL programs commercially available (it won a 1988 EDUCOM/NCRPTAL Higher Education Software Award) is Système D (Heinle*), a “writing assistant for French” which is a basic French word-processing program with very fast access to a 4,300-word lexicon including usage examples, a full verb conjugator, reference grammar with examples and notes, and thematically related groups of words and expressions for a large number of conversational functions, all of these accessible from virtually anywhere in the program. Students thus have at their fingertips everything they need to write compositions for elementary or intermediate French. The program includes no feedback facility, so teachers can do what they like with printouts of the compositions. (Companion versions in Spanish and German are under development.) Now that computer FL dictionaries are available (CALI*), we can look forward to lessons which streamline students’ access to these in the course of reading and writing assignments.

Advanced Study. The use of language software as a tool or resource rather than as tutor or drill-master points to a rapidly growing area of interest. Some of the most interesting technology-based material in other disciplines uses the computer (with or without interactive technologies) not as a device for delivering instruction but as a richly supportive environment for learning, as a medium not for the teacher presentation and learner drilling of pedagogically selected facts about a field of study, but for the learners’ exploration of the primary data of the field. That is, students work with programs which do not so much teach them facts about chemistry or history or math but rather lead them to think and behave like chemists, historians, or mathematicians. The implication for language education is the possibility that researchers could use technology to create an environment in which students might learn some of what is involved in behaving like native speakers or, at later levels of study, like scholars of language or literature.
Advanced level undergraduates and graduate students can be offered the opportunity to use the technology to deal with authentic data themselves, even to undertake original research. For example, Garotd Davis (Brigham Young University) teaches an undergraduate course on Faust in which students are taught to use WordCruncher (CALI), a program which allows the development of sophisticated concordances. Students are given paper-writing assignments based on suggested searches. Other text-analysis programs and scholars’ tools are arriving rapidly on the scene, and their use should be integrated into upper-level courses for two reasons: first, a great deal of language learning takes place when the learning effort focuses not on the language itself but on some task which the use of the language accomplishes, and, second, in today’s job market familiarity with advanced technologies, for both teaching and research purposes, is a significant advantage to a new PhD.

Although the four skills are not by any means fully developed in the first two years of language study, after that the pedagogical focus, for those students who continue, shifts largely to the development of the ability to read, discuss, analyze, and criticize literature. Part of the bias against technological development of the ability to read, discuss, analyze, and criticize literature. Part of the bias against technological material, which is perceived in many departments as less important, less intellectually interesting, than teaching literature. Quite aside from the justification for that perception, the technology can in fact facilitate the move from a focus on language to a focus on literature. For example, authoring systems mentioned above for creating reading comprehension materials could allow the preparation of lessons helping students make the transition from pre-digested or specially prepared reading texts to original literary texts of all kinds. An advanced version of a writing program like Système D, with lexical, syntactic, and discourse organization helps at advanced levels, could provide the reference language data which would enable a student to write a literary essay as well as a Dear Abby letter.

A videodisk holding up to 52,000 slides could be a fantastic resource for a whole range of advanced courses, within departments and for cross-disciplinary courses. This resource can be far more than an expensive new way to deliver pretty pictures; it can bring new intellectual and cultural dimensions to literary study. A course on German literature of the Jugendstil period or on French surrealist poetry, for example, is intellectually complete without visual material. Most language departments offer courses on culture and civilization for which easy access to visual and audio material is absolutely essential, but many teachers have neither the cultural background nor the institutional resources to pull together the desired collection, nor any easy way to provide each student with the appropriate cultural notes and textual references. One videodisk could hold the visual material for dozens of computer-based lesson modules, with study aids such as cross-reference suggestions and leading questions. As for moving video, although the thirty-minute video capacity of the disk does not allow easy delivery of entire performances of plays, it is ideal for comparing segments or for developing in-depth analysis of scenes which the student may need to view repeatedly or in juxtaposition with various other materials. Culture courses which are often elected to fill general education or humanities requirements could be supported by two sets of audio and video materials, in the appropriate language as well as in English, so as to make them both more broadly useful and more demanding for the departmental major.

The concept of hypertext and the availability of programs supporting the creation of hypertext materials has produced a surge of interest in the development of a new kind of CALL software. Hypertext refers to a collection of various text materials, related in complex ways, which are not designed to be read in a linear fashion, from beginning to end, but explored in an almost infinite number of different ways through complex cross-referencing. By analogy, hypermedia programs also make easy the integration into this kind of branching structure of audio and video materials (as well as graphics) along with text. The basic nature of hypertext and hypermedia programs makes them particularly suitable for the presentation of material for students to explore as they choose. In a reading comprehension presentation, for example, the program might allow the student to select certain words with a mouse or cursor and be taken directly to a synonym, paraphrase, translation, grammatical analysis, map, picture, audio rendition, or cultural note. Any of these could then offer links to other information or back to the original text. In reading a literary text the student could call up biographical information on the author; explanation of symbolism; historical, social, or political contexts; interpretations offered by one critical theory or another; or information on other works published in that period in other literatures, particularly relevant works of art or music. The possibilities are
Intoxicating. Hypertext programs can also be used to create materials structured as lessons, with answer-judging and feedback. Novice lesson authors can learn to create very simple lesson materials in about two weeks of intensive effort.

The concept of hypertext has been familiar to computer scientists for several decades, but became accessible to non-expert developers of computer-assisted instruction only with the introduction of HyperCard two years ago. HyperCard, an authoring system for the Macintosh (it now comes packaged with each new Mac), allows easy creation of immediate links from any point in a program to any other or to a different program altogether. (HyperText is the generic name for the concept underlying this kind of information structure; HyperCard is Apple’s product.) Other commercially available hypermedia authoring systems are CourseBuilder for the Macintosh (TeleRobotics*), IconAuthor for the IBM and Apollo (Aimtech*), and LinkWay (IBM).

HyperCard is probably the most widely used system on the market, and it is undoubtedly a very powerful and attractive tool. This author knows of only one company (HyperGlot*) publishing HyperCard materials for language learning, but the enthusiasm seen in HyperCard user groups on campuses across the country strongly suggests that much more material will follow.

EVALUATION

Intelligent evaluation of technology-based language materials is not easy for teachers who are unfamiliar with them. Two criteria are obvious: the first, which applies to any instructional materials, is that the language context be correct, authentic, and appropriate. The second is that the program run as it should, without bugs, without crashing. But only these two criteria are absolute. A package judged unacceptable by one teacher for any of a number of reasons may adequately fill a specific need for another. No reviewer, no matter how expert or objective, can evaluate a package and establish a rating which is equally valid for all potential users. Most teachers are hard put to “keep up with the literature” even with regard to their own special research interests, whether in methodology, in applied linguistics, or in literary studies. A nearly Herculean effort is required to keep abreast of the tidal wave of additional material being published on technology. Nonetheless, those who have the responsibility for choosing or recommending instructional materials for purchase should probably skim a large variety of publications, not limiting themselves to their own language journals.* It is increasingly common for a software program to be published simultaneously in versions for several languages; while a general review could turn up first in the publications not focused on one language (Modern Language Journal, Foreign Language Annals), a software program might be reviewed first, for example, by a German teacher in Unterrichtspraxis, while the Spanish teacher to whom it could be equally useful might not find it reviewed in Hispania for several months. Sometimes a program published for ESL teachers will include the capability to handle FL characters and accents and could therefore be useful to FL teachers as well, but it may be reviewed first (or only) in an ESL journal and thus not come to the FL teachers’ attention. And of course the decision whether or not to purchase or even examine a program ought not to rest on one review. (Those who have the responsibility for making recommendations to a department or language teaching program have good reason to insist that they be given some release time or assistance.)

Another reason to browse through a variety of publications for software reviews is that their tone or approach may vary widely. A review written for a teacher who is familiar with computers, with programming, or with using software in teaching may be incomprehensible to one with little or no experience in these areas. Some reviews are little more than descriptions of the format and content of a lesson and evaluate only by the two absolute criteria mentioned above. Other reviews are predicated on assumptions or value judgments which the reader may not share; if a reviewer believes that verb drills are pedagogically reactionary, a verb drill program may be so negatively reviewed that a teacher who believes that such drills can be useful may not be able to tell whether the one in question is suitable. Similarly, if a reviewer strongly prefers the Macintosh to IBM-type machines or vice versa, reviews of programs which run on one or the other may be biased.

It was suggested earlier that software should whenever possible be examined directly as well as judged via reviews. Looking beyond those two absolute criteria for good software, how is an inexperienced teacher to judge a package? First and foremost, the needs, abilities, expectations, and special characteristics of one’s own learners must be kept in mind. Will they enjoy music and sound effects or find them tedious? Do they need to be taken through material step-by-step or could they be allowed to decide their own ordering of activities? Are they highly motivated enough to stick with the material for efficient learning, or are they likely to quit an activity without

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completing it—and should that be discouraged by the software? Should they be forced to type in the correct answer if it is shown them after several incorrect attempts? In drill-and-practice software, is the “analysis” of students’ errors based on adequate understanding of the student’s task and the possible misconceptions that would lead to error? Are the feedback messages similar in tone and degree of specificity to the teacher’s own approach, and will they be understood and perceived as helpful by the students? Such evaluations can only be made by the teacher on the basis of acquaintance with the particular students in the particular situation.

Teachers often find it difficult to go through a lesson from the point of view of students; they tend to give the right answer each time and to look for the correctness of the language to the exclusion of other considerations. All software should be tested as it will be used by an unmotivated, mischievous, or not very able student, to give a wide variety of unexpected and wrong responses at every turn. What happens if the student simply cannot guess the correct answer—is there any way to pass the item or to see the answer so it can be typed in? What happens if the student doesn’t attempt to answer but presses Enter or the space bar? (Some programs automatically show the correct answer, and some students, on discovering this, go through the lesson without making any effort to respond.) Does an extra space accidentally typed into the response cause the answer to be judged incorrect? How are inappropriate uppercase and lowercase letters handled, or missing or superfluous accents? Are correct variants of the answer accepted?

**Software Design.** Computer lesson design is particularly difficult for teachers to judge. In the early days of CALL, lessons were produced by programmers with sometimes only a rudimentary knowledge of the target language and no particular pedagogical expertise. Later, teachers who had learned to program, or teachers together with programmers, developed lessons which followed familiar exercise formats. But even experienced and pedagogically sophisticated teachers, teamed with expert programmers, do not automatically produce well-designed lessons. Design features can undermine the effectiveness of the program in ways which need not be considered in evaluating textbooks. Screen design is not only an aesthetic but also a pedagogical matter. For example, is the use of color, or of different typefaces, rational and consistent; does it carry out some organizational or pedagogical function? Is the screen so full of text that it appears dense or heavy, making information harder to absorb? Is all the information students need to perform the task shown on the screen at all times (how to type accents or return to a menu, for example) and does the same information appear at the same location on the screen throughout the lesson, so students know exactly where to look for it? Do students know where they are in the lesson at every point, how to get at some other part if they need to, and how to get back to where they are working? Will an accidental random keypress get them lost? Many of these details seem trivial, but the accumulation of enough minor inconveniences can impede or even prevent learning.

**TESTING**

Computer testing can refer simply to the computerized administration of conventional tests (on material which may or may not have been practiced on the computer), where the computer may only collect the responses or may also judge them and tally scores. Many commercial drill programs include a “test” section in which the students are scored on previously drilled material. Anecdotal evidence from GALL-experienced teachers suggests that giving computerized tests for “real” grades is undesirable, because typographical errors and unintended keypresses may result in lowered scores for less skilled or nervous students. More important, the psychological advantages of using the computer as all-patient tutor or near-infinite resource in language learning activities may be seriously compromised if it is also used to evaluate work for grade assignment.

**Computer-Adaptive Testing.** Computer-adaptive testing (CAT) depends uniquely on the computer’s ability to select items one at a time from a large item bank on the basis of a continually adapting diagnosis of the individual examinee’s level of ability. Such a test is prepared by ranking hundreds of items by degree of difficulty. The level of difficulty of the first item presented to the student is established on the basis of outside criteria such as course level. If the student gets the first item right, a slightly more difficult item is presented; if it is answered incorrectly, a slightly lower ranked item is selected. The computer keeps a running record of performance on each level of difficulty and can very quickly arrive at a statistically well-motivated assessment of the student’s performance level. Much controversy
exists over the appropriateness of CAT for a field as complex as language, but computer-adaptive placement tests have already been developed at Brigham Young University by Jerry Larson (Spanish) and Frank Otto (ESL).

The concept of CAT is clearly analogous to that underlying the ACTFL Oral Proficiency Interview, in which the interviewer establishes a sense of the student’s general level of proficiency and then attempts to elicit responses at higher levels, constantly adjusting the difficulty of the next question by the student’s overall performance. ACTFL is currently developing a computer-adaptive reading proficiency test as the logical sequence to the Oral Proficiency Interview, and Robert Ariew (Arizona) and Patricia Dunkel (Pennsylvania State) have worked on computer-adaptive listening comprehension tests. Such tests are not for everyday use, but they have great potential for placement and various certification purposes.

AUTHORING

Many technologically inexperienced teachers believe that if they do not like the “closed” or “fixed” commercial software materials which can only be used as they come off the shelf, they have no alternative but to program their own “from scratch,” something most teachers are understandably loath and/or unable to do. Actually, one could describe a five-part continuum of the degree of control or input possible to the teacher in “creating” a lesson (7). At one extreme are those fixed lessons, which allow no modifications of any kind. Next on the continuum are “template” or “shell” lessons, which provide one or more pre-programmed lesson formats which come with a certain amount of content material, but which also allow the teacher to edit or add to that content, for example, to create new vocabulary lists which can be run by the program in the given drill format. At their simplest such packages at least allow teachers to adapt lessons to their own textbooks or their own students’ needs, and therefore they can be a very useful first or second step in experimenting with computer use. But the actual operation of the lesson remains totally fixed in these lessons; the teacher cannot change, for example, the number of times the student is required to attempt an item, or the feedback message, or whether the definite article must be included in the answer, or whether an accidental space will cause a correct answer to be judged as wrong.

In the central position on the continuum is the authoring system, a program which allows non-programmers to choose and assemble a variety of features to make a lesson look and run exactly as they like and fill in the content they want as well. All authoring systems vary in flexibility and ease of use: the more structured and internally specified an authoring system is (i.e., the fewer options it allows the teacher), the simpler it will make lesson creation. Some authoring systems on the market are principally intended for designers of industrial or business lessons; others, such as Quest (Allen Communication*), CourseBuilder, and HyperCard (mentioned above in the context of hypertext) are designed for educators in all fields. Probably the best known of those designed specifically for language lessons are Dasher for the Apple II (Conduit*), CALIS for the IBM (Duke University), and MacLang (Gessler*) and Private Tutor (Stephen Clausing, Yale University) for the Macintosh; all of these are designed for relatively straightforward exercise generation and are fairly easy to learn to use because they do not for the most part introduce new lesson design concepts. Still, teachers who have not learned to program or to evaluate software in their own teaching context may wish to experiment with fixed packages or driver programs before attempting authoring. Once they have developed their own criteria and a sense of what kind of lesson they want students to engage with, they will have a better basis for choosing the most appropriate authoring system.

At the next point on the continuum are authoring languages, which provide shortcuts for common programming operations, but the use of an authoring language really requires a good understanding of programming. Finally, basic programming uses a programming language such as BASIC, PASCAL, or C to specify every detail of content, format, and operation.

SOURCES OF INFORMATION

Organizations and Journals (see Appendix for a list of the full names and addresses). The most directly focused sources of information about the use of technology in foreign language learning and teaching are the organizations dedicated specifically to that use, CALICO and IALL (formerly NALLD, the National Association of Language Laboratory Directors). Both of these organizations publish journals and they both hold annual conferences where the presentations, the workshops, and the exhibits all focus on the uses of technology in language education.

In addition, the conferences of all the regular foreign language teachers’ organizations (the
NCRIPTAL, ADFL, ACTFL, MLA, TESOL), both on the national level and on the regional and state levels, now regularly include technology-oriented presentations, workshops, and exhibits, and the newsletters and journals of these organizations include frequent articles on technology use and reviews of software, as does The Modern Language Journal. The ERIC Clearinghouse on Languages and Linguistics and the Center for Applied Linguistics maintain extensive data bases of relevant information available to teachers. The MLA now has a standing Advisory Committee on Computers and Emerging Technologies, which contributes items of interest to the MLA Newsletter.

Several other organizations focus on the use of technology in more broadly defined areas of education. The Association for Computers and the Humanities tends to focus more on the use of the computer as a tool by scholars in carrying out literary and textual research than on its use in delivering instruction, but its publications (especially Computers and the Humanities; Vol. 23, i, 1989, was a special issue on Intelligent Computer-Assisted Language Instruction) and conferences are valuable to the foreign language teacher whose teaching and/or research interests bridge the gap between language and literature. EDUCOM*, a national consortium of educational institutions, teachers, and technology manufacturers, is dedicated to the development of educational computing in all disciplines; it holds national and regional meetings, conducts seminars, and together with NCRIPTAL*, sponsors an annual competition for excellent educational software and technology-based instructional programs. EDUCOM puts out a newsletter and numerous other reports and publications; it has sponsored the publication of Computing across the Curriculum: Academic Perspectives (Academic Computing, 1989), which includes a chapter on computing in FL education.

In addition to the journals which are concerned with language teaching generally, those which address the teaching of one particular language, and those which explore the use of technology for education, the countless publications which focus on the technology for a wide variety of other purposes, such as business, may also contain material of interest to foreign language teachers.

State boards of education are increasingly aware of teachers’ need for information and support, although in many cases foreign language teaching tends to be relatively low on their list of priorities. Illinois, for example, funds a network of regional Educational Service Centers (ESCs), each of which provides information, workshops, demonstration materials, etc., to the teachers in its geographical area. Even when the mandate of such boards does not include foreign languages, their staff members are generally eager to be of as much use as possible and can often refer foreign language teachers to other sources of information and help. Even if no support structure yet exists in a given state, insistent requests from concerned teachers may prompt its creation.

Hardware manufacturers, too, are increasingly concerned with helping teachers realize the potential of technology; they know that without real integration of computer use into the curriculum, which in turn depends on the availability of good software, the hardware will not sell to educators. In 1983 IBM developed a program called ACIS (Academic Information Systems) through which it has funded materials development projects in instructional computing in a wide variety of fields at nineteen campuses across the country. (These grants, referred to by IBM as AEP [Advanced Education Projects], had their own names at different campuses: the IBM projects at Princeton were called PEGASUS, at Cornell, EZRA, at Illinois, EXCEL, etc.) ACIS holds national and regional conferences where faculty from these campuses discuss and demonstrate their projects and hold panel discussions on issues of interest to specific subject areas. Apple holds similar national and regional meetings for educators interested in the Macintosh. (Although foreign language teachers who can afford to go to any conferences tend understandably to use their funds for FL meetings, those interested in the potential of the technology will also find much of interest in these more general gatherings. Educational innovations in other fields can suggest exciting and provocative ways to rethink one’s own traditions and conventions.)

Some of the software developed by teachers in these grant programs can be acquired by the public. WISC-WARE* is a consortium which distributes the research and instructional software developed at the nineteen AEP campuses. At WISC-WARE Demonstration Centers on many campuses teachers can evaluate and order software. A listing of academic software for the Macintosh is available at Kinko’s quick copy centers, and software may be ordered there. Teachers should keep in mind, however, that software offered through WISC-WARE and Kinko’s is only cursorily refereed; some packages are excellent, others may represent old-fashioned pedagogical principles or perhaps highly idiosyncratic ones, and some materials may still be at an early stage of development. Caveat emptor!
In an effort to upgrade the standards of instructional software and to raise the visibility and status of software authors in their own disciplines, IBM has supported the establishment of software evaluation committees in several discipline-specific professional societies, including the Modern Language Association and the Center for Applied Linguistics. The MLA committee handles software for English and foreign language, the one at CAL for linguistics and ESL. These committees adjudicate the submission of faculty-developed software for use either in teaching or in research which has not yet been published commercially. The committee members evaluate the software, much as referees for journals evaluate articles submitted for publication, and like journal referees may make recommendations to the author for revision or improvement. Software judged to be exemplary and of interest to the profession is published through TASL (The Academic Software Library), an IBM distribution mechanism.

IBM has also instituted a Consulting Scholars program, providing full travel costs for major figures in educational computing to visit campuses all over the country to speak on the state of computing in their field and to discuss problems and possibilities with interested faculty. Two of these Consulting Scholars have come from foreign languages: James Noblitt, Professor of French and Linguistics, who with his colleagues Donald Solá and Willem Pet developed Système D at Cornell, and Edna Coffin (Michigan), whose Hebrew interactive videodisk program A Safe Affair won a Distinguished Software Award in the 1989 NCRIPTAL/EDUCOM competition. In September 1989 IBM opened an Institute for Academic Technology which will undertake research on the development of educational and research software in foreign languages and in math and science; Noblitt is currently a Fellow there.

Books. The Appendix contains a list of books which could be of use to the foreign language teacher. The list is by no means exhaustive, and it is impossible to provide a detailed enough description to allow readers to guess the usefulness of one or author volume at their own level of expertise; as with reviews of software, teachers will need to browse and compare notes with more experienced colleagues to find the most directly useful information.

Workshops and Teacher Training Programs. The discussion of teachers’ conferences above included mention of the technology-oriented workshops they often include; these are usually only three hours long, sometimes six, and are most often at a basic or introductory level. Similar half-day workshops on CALL are frequently arranged for teacher inservice days and school district meetings. Such workshops may provide a general introduction to the basic idea of CALL, or they may demonstrate software, or—if set up in a computer classroom—they can give teachers an opportunity to try out many different software packages. As this paper should have made clear, however, teachers cannot hope to learn very much about CALL in so brief an exposure. Moreover, technological beginners find it strenuous if not actually anxiety producing to deal with technology, and the number of hours they can productively concentrate on it is limited. And, sometimes, it must be said, these workshops are given by teachers who have become so unreservedly enthusiastic about the technology that their presentations are more like sales pitches than objective and helpful discussions.

Summer programs offer a more extended opportunity for becoming familiar with technology in FL education. CALICO* has for the last several years sponsored summer institutes, and the 1989 Linguistics Society of America Summer Institute at the University of Arizona included courses on technology; the University of Illinois’ CALLIOPE project (Computer-Assisted Language Learning and Instruction Outreach Project in Education, 1985–88) included two intensive summer institutes in 1986 and 1987. NCRIPTAL* offered a workshop on guidelines for software development (not specifically geared to foreign languages) in summer 1990. Teachers interested in workshops should request as much detail as possible in advance. Workshop descriptions should make clear whether they are designed to teach teachers only to evaluate and make use of technology-based materials or actually to produce them and, if the latter, whether by teaching programming or by teaching authoring. Workshop sessions should ideally be given not by computer scientists, nor yet by humanities computing experts, but by language teachers who have technological expertise but who can still approach the material from the perspective of the nontechnical teacher. Even for those who do not want to get into programming, but only to make use of fully developed lessons or to use authoring systems, some introduction to basic principles of programming and to the computer’s internal workings is important, and a good deal of practice in software evaluation is essential for all. For complete beginners a workshop that proposes to teach the evaluation of software and techniques for its integration into FL teaching
should probably take two weeks of full-time commitment. Beginners learning to author materials even with the simplest and friendliest authoring systems will find themselves under extreme pressure in a program less than three weeks long. Those who want to learn programming for language lesson development should be prepared to give the effort at least six weeks of full-time concentration as an introduction (and should probably ask their spouse’s permission for at least a year’s worth of total spare-time commitment!).

When inquiring about workshops teachers should indicate their own level of computer experience very clearly and ascertain that the level of instruction will be appropriate for them. Unfortunately, workshop hosts sometimes advertise their programs as being designed for the complete beginner but then accept all applicants for financial reasons, regardless of level of experience, and this creates difficulty for both teacher and student, unless participants at different levels can be grouped separately. Applicants themselves sometimes inadvertently misrepresent their own degree of expertise. This author was once part of a team giving two workshops at a teachers’ conference; the morning one was advertised as being for the complete beginner and the afternoon one as advanced, for those with enough experience in CALL to address several technologically sophisticated topics. The morning session went well, but the workshop organizers were horrified to discover that among the afternoon participants were a number of the morning’s novices, who had assumed that on the basis of one three-hour workshop they were now advanced learners.

Regular academic year extension courses or semester-long workshop series are probably the best way for teachers to learn about the use of the technology. A once- or twice-a-week program allows teachers not only the time to absorb and work with new concepts and techniques but also the opportunity to introduce such techniques gradually for their own purposes into their own classes. In some school district’s language teachers have set up informal working groups, meeting perhaps one evening per week or alternate Saturday mornings, to examine software and exchange ideas and techniques, sometimes with the help of technologically experienced staff from a nearby university. Universities for their part are becoming aware of the mutual advantages in working with secondary school teachers in this way. Funding sources, both public and private, are often eager to support such consortial groups, and interested teachers should encourage their colleagues to join in exploring the possibilities.

GENERAL ISSUES

One obstacle to getting involved with technology is the prevalent fear that the path into the technological jungle is steep and slippery and that it is difficult to explore it without becoming entrapped. Conservative teachers fear that the technology will weaken or interfere with their control of the class and are willing to consider only those technology-based materials which perform electronically the most traditional teaching tasks. On the other hand, the most enthusiastic converts sometimes get carried away by the sheer fascination with the new capabilities and “computerize” activities whose pedagogical value is doubtful. Successful integration of technology will require new perspectives and new theory; we need to rethink many of the language activities we ask students to engage in before we bother to computerize them.

Whether the primary focus of technology-based language education should be the teacher and the instructional process or the student and the learning process—CALI (computer-assisted language instruction) or CALL (computer-assisted language learning)—is not a quibble. The greatest part of present FL software material is devoted to grammar and vocabulary lessons, the underlying assumption of which is the notion that language is a set of facts, information, or habits in which learners must receive instruction, over which they must demonstrate mastery. All the early software was conceived of as assisting teachers, freeing them from the tedious mechanical tasks that grammar and vocabulary are still widely thought to be. Language acquisition theory of the past fifteen years has persuasively suggested other perspectives. Language is now more often seen as a dynamic interactive system for conveying meaning, and language learning is the acquisition of the ability to construct communicative meaning in a new system. 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, and we are increasingly aware how differently students undertake the process of acquisition. In this theoretical climate CALL (in contrast to CAI) is flowering.

But to reject all drill-and-practice materials would be to overreact. Language learning always entails some habit formation, for which computer drills can be ideal. However, there are significant differences between good drills and bad drills; the best ones on the computer (those which accept several correct answers and give specific feedback messages, for example) are probably better
Individualization has always been touted as one of the major advantages of GAI, but until very recently the goal of individualization has been realized only in the inherently “self-pacing” nature of most computer lessons (except for timed activities like games). Students can move through the material at their own pace and can repeat or sometimes skip segments of lessons according to their perception of their own need, but the material contained in the lesson, the way it is presented, the analysis of the students’ performance, is the same for all. 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 who tend to have—for example—a field-dependent or a field-independent cognitive style, or provide different scoring strategies for those who tend to be impulsive or cautious, to mention only two possible differences out of many which shape learners’ interaction with materials. One kind of hint or feedback message will be useful or congenial to some learners but altogether unhelpful to another. Experienced and sensitive teachers have intuitions about their individual students’ problems, strategies, motivation, and personal style, but they have only limited time and cannot provide explanations from numerous different perspectives or individually tailored feedback for every student. Sophisticated programs should eventually allow students to choose from a variety of approaches, though to choose appropriately they themselves will have to learn to understand their own learning styles and strategies.

The shift to an idea of CALL that stresses individual learner characteristics and the learner-centeredness of the learning process does not necessarily point to just those uses of the technology that give the learner direct access to authentic language, in text, audio, or video. In fact, those users raise a whole new set of extremely interesting questions. The assumption underlying much of the current enthusiasm for interactive video and for hypertext, that authentic data will give learners the best sense of the new language and culture, is reexamined by Nostrand (9), who warns that without guidance students are apt to interpret authentic materials in terms of their own stereotypes and prejudices; he speaks largely of text, but the same is true for video. Should students only engage 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? Shouldn’t that question be broken down, posed instead as: for what kind of learners, or at what level of learning, or for which NL-target language relationship, would pedagogically organized materials be more helpful than raw data, or vice versa?

The rush of enthusiasm for HyperCard and for other hypertext and hypermedia programs should give us ample opportunity to explore questions based on cognitive and educational psychology. So far that enthusiasm has largely been generated by teachers and scholars who can see very clearly how they would use such complex materials or how they would like their students to use them. But will students use them in those ways? If learners have access to a lot of data regarding something they need to know an unspecified amount about—reference materials, or related bodies of more or less directly relevant information, far more than can realistically be accessed—what do they in fact look up? Do they know what they need to look for? How do they make use of it? In the long run do they perhaps learn as much from browsing, in what might seem to us an inefficient or purposeless way, as from directed exploration? How freely does what kind of student at what level of learning browse and explore? Do learners get lost moving around in an infinitely complex set of related data? What kind of student gets lost under what circumstances? What kind of lesson structure or visual clues tend to prevent their getting lost?

We need to rethink some poorly motivated methodological mandates against correcting errors. For which learners, at what level, for what purpose, can error analysis be most helpful? What kind of error analysis? What kind of deliberate shaping of the environment will have lasting beneficial influence on the smoothness of the learning, the efficiency and accuracy of an individual learner’s hypothesis-testing? How do we establish the criteria?

RESEARCH

Obviously, a great deal of research is needed, not only on carefully defined questions of pedagogical efficacy, but also on details of the learning experience and the nature of learners’
idsyncratic language processing. 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 feed directly back into improving pedagogy but can also contribute to the development of second language acquisition theory. In principle, of course, teachers can always collect data on their students’ learning, but the exceptionally heavy teaching loads carried by most FL teachers strongly militate against their doing so. The time and thought required to design significant research will be the same regardless of research methodology, but once a task has been created on the computer it can not only collect but also perform analyses on a far larger number of students and far more complex data than any teacher could possibly handle otherwise. Unfortunately, ordinary scores collected on the use of most software lessons are likely to be totally unrevealing: the fact that a student gets a score of eighty percent on most conventional grammar or vocabulary or reading comprehension tests tells us nothing about the mental representation of the target language or what can be communicated with it, but that is, in fact, true of scores on most non-computer-based tests, too.

Furthermore, the computer can enable research we cannot undertake any other way, because it can collect data on the learner’s process of dealing with language, rather than only on the product, the final sentence or total score on a set of items. For example, a pilot research project at Cornell has attached a tracking program to Système D so that individual students’ every keystroke is recorded—what they write, what they look up at what point in the composing, what use they make of what they look up in the next words or phrases written, for what kind of assignment, etc. (8). Independent measures of student characteristics can also be collected—level of study, aptitude, and cognitive style—so that the data support real insights into how learners think when they go about writing in a foreign language. Similar projects can easily be imagined to investigate how learners develop reading or listening comprehension or cultural understanding or how they make use of hypertext or hypermedia to build their own notions of meaning in the target language.

In more complex computer-based projects the computer can not only track what the learner does in the learning environment but also interact with it; lessons should be designed to respond or provide feedback of some kind to learners’ input and to collect data on how they make use of that feedback. For example, in a grammar activity requiring students not just to select the correct form from a paradigm but rather to express a certain meaning, correction attempts after feedback can be extraordinarily revealing of students’ own idiosyncratic hypotheses about what a given structure really means or how structure and vocabulary, interact in expressing meaning of all kinds—socio-linguistic, pragmatic, and discourse meaning as well as semantic.

Technology-based classroom research thus can be of direct use in shaping our pedagogy (both materials design and the classroom approaches into which material use is integrated) and at the same time can contribute significantly to a growing body of second language acquisition theory. Both efforts are crucially important; the ability to combine them in technology-based projects represents a major new opportunity for teachers. As yet very few projects along these lines are being undertaken, because no commercial software allows the collection of data beyond raw scores, so that interested researchers must develop their own instruments, but the potential is gradually coming to be recognized.4

PROFESSIONAL REWARDS

Teachers who devote the time and energy necessary to create technology-based materials for their teaching are understandably frustrated by the continuing reluctance of most departments, at least in research universities, to recognize mis work with promotion and tenure. Unfortunately, it is difficult for chairs and promotion committees, who are seldom involved in such development efforts themselves, to distinguish between conventional materials being delivered electronically and genuinely innovative materials whose development is based on some theoretically or pedagogically sophisticated rethinking of FL education. The MLA committee mentioned above is concerned about this issue and is interested in working with faculty and department heads to develop guidelines and perhaps a list of names of recognized experts to act as referees. One way of resolving the issue, however, is to make the development of technology-based learning materials an integral part of a research project, as suggested above, since publication of papers on the research will make an unarguable contribution to the
CONCLUSION

This paper has surveyed the ways in which computers, audio, and video are already being used both to assist FL teaching and to create complex and supportive environments for language learning and has also sketched out some new approaches to technology-based materials development which are beginning to be implemented or already envisioned in software assisting the learning of grammar, vocabulary, reading, listening, writing, and culture. It has suggested that technology can play a major role in foreign language learning and in research on that learning. However, the development of the potential of technology-based materials is still in its early stages, where software lessons tend to follow familiar designs for conventional purposes rather than exploiting new capabilities for implementing and testing theoretical principles of classroom language acquisition for learners’ benefit. Issues on which the realization of that potential depends were also explored here: the shift from thinking of technology as assisting instruction to thinking of it as supporting learning; the problems attending the evaluation of technology’s efficacy; the prerequisites to genuine individualization of software; the advantages and disadvantages of pedagogically shaped as contrasted with authentic materials and of learner control over the learning environment. All of these issues are related in complex ways to the perspectives brought to bear on foreign language education by theoretical considerations in second language acquisition, but they have to be addressed in the actual pedagogical situation, as they affect our learners in the classroom and the language media center.

The most important potential of the technology is for integration. We are concerned about the tendency in language education to see the teaching of language and culture as separate, even if complementary, but with video we can present language in its cultural context. Language and literature are often separated in our curricula, and learners often experience a difficult transition from reading pedagogical prose to reading authentic texts and from hearing pedagogical audio to understanding natural spoken language: the computer and interactive technologies will allow teachers to select materials of all kinds, support them as learners’ needs dictate, and use the visual options’ of screen presentation or the interactive capabilities of computer control to help students develop good reading or listening techniques. For many language teachers research and teaching are two separate activities; literary scholarship often has little connection with language teaching, methodological research may not be valued, and teaching loads may prevent the undertaking of either. Using technology-based materials to collect data on the learning process may well develop into one of the most interesting options for both pedagogically and theoretically motivated research.

As the classic joke format has it, there’s good news and bad news. The good news is that the technology does offer the potential for enormous enhancement of foreign language learning. The bad news is that that potential cannot be easily realized. It is not just a matter of spending money, of consulting the experts, and most certainly is not a matter of waiting for more sophisticated machinery or programming techniques. With or without budgetary or logistical constraints, there simply is no such thing as an ideal configuration of hardware or an ideal set of software for language learners in general, and there probably never will be. Deciding what is best in any particular situation will always require a teacher’s considered analysis of that situation and detailed information on the currently available options. But while we deal with the realities of foreign language education today, it is not visionary, but common sense, to consider how we would like to see the field developing in the next decade. Some of our most important priorities—focus on the individual learner, a true integration of the teaching of language and the teaching of cultural understanding and literature (not just a smooth articulation between them), bridging the gap between theory and classroom practice—can be strongly supported by intelligent uses of technology. But these will not be accomplished unless and until teachers themselves take the initiative to think through what the technology should be able to do for them and for their students and make their needs known.

NOTES

1 I am indebted to the Director of the Language Learning Laboratory of the University of Illinois at Urbana-Champaign, C. C. Cheng, its Associate Director, Robert S. Hart, and members of its staff (Junetta Gillespie, Rachel Manwell, Ulric Chung, and Rick Treece) for their help in preparing this paper. I am also grateful to others who supplied information and references: Robby Ariew, Patricia Dandonoli, Patricia Dunkel, Glyn Holmes, Jerry Larson, Ronald McCrary, James Noblitt, Sue Otto, Sharon Scinicariello, and some anonymous reviewers. Any oversights or mistakes are my responsibility. I regret that it was impossible to mention all the interesting work that is being done in this field.
around the country; dozens of other people and programs might well have been included.

2 Personal communication from Seth Levin, Editor, Gessler Software.

3 In the following sections general reference is made to various kinds of software, in most cases without specifying any particular package. Apologies are made to the teacher who finds this frustrating, but software publication changes so rapidly (new packages are brought out, earlier ones reissued for other hardware, outmoded ones dropped from catalogues) that any set of references compiled at this writing would be out of date before this issue appeared. Moreover, any given program may be available in one language or several, for one machine or several, so that more specific references might still frustrate most readers. The interested teacher is strongly urged to write to publishers (addresses listed in the Appendix), to read a variety of journals which publish reviews (also listed in the Appendix), and, most of all, to attend at least one of the major language teaching conferences and spend significant time in the exhibit area.

4 The author would be very much interested in hearing from teachers who have done computer-based research along the lines suggested here or who have ideas for such projects.

BIBLIOGRAPHY (for this paper; for general references, see Appendix online)


