Books and Computers: Taking Advantage of New Media in Language Learning

The computer screen is a device for finding out how to use the power of our minds. It is also a means of making contact with other minds.
—Timothy Leary

The best way to predict the future is to invent it.
—Alan Kay

Books and computers are different. While both employ similar organizational conventions that go all the way back to the roots of recorded civilization in the Levant, their capabilities are quite different, yet we are only beginning to implement some of the computer's potential as a medium of transmitting information for the purposes of learning and self-instruction. In this short paper, I would like to examine some of the differences between the book and the computer as media for language learning. I will cast a brief glance at the history of information storage and transmission, attempt to define the chief characteristics of books and computers, suggest some guidelines for creating new learning tools with computers, and finally offer some examples of the application of these principles in an ongoing project I have undertaken to transform my ESL textbook *Fast Fluency* (Boletta, 1991a) from its original book medium to a computerized format.

Books, Computers, and Storing Information outside the Brain

At the outset, I would like to express my indebtedness to Tom McArthur, whose brilliantly suggestive book, *Worlds of Reference: Lexicography, Learning, and Language from the Clay Tablet to the Computer* (McArthur, 1986), has helped me to see that the computer is the inheritor of the entire tradition of learning, East and West. Rather than view the computer and electronic digital storage as a discontinuity in the course of the history learning, a rupture with the past as some Luddite types even today still imagine,

McArthur shows that the computer, while a drastically revolutionary medium, is at the same time but another chapter in the long history which extends from cuneiform inscriptions made in the soft clay of Sumeria to digitized storage made possible by the advent of the transistor and the silicon chip. McArthur sees the entire history of learning as a gradual progression in human ability to record information elsewhere than inside one's own head:

The species *Homo* has created over two million years a sociocultural chasm between itself and other living creatures that inhabit the earth. The taming of fire, the making of tools, the possession of sophisticated shelters, the growth of social ritual and the evolution of speech have all contributed to the widening of the chasm, but until breath-takingly recently in terms of geological time humankind shared with cats and chimpanzees one similarity: whatever events they experienced and observations they made blew away like smoke on the wind. Whatever they passed on to future generations was done either through the genes or immediate personal contact, leaving no consultable record.

At some precise point, however, *Homo* reached a take-off point, a kind of critical mass after which a whole chain reaction of achievements became possible—including *the storing of information elsewhere than in our brain*. (McArthur, 1986, pp. 3-4; italics mine).

It is under this general conceptual umbrella that we need to view the gradual progression from gesture to writing to printing to digital storage. We already use terms like "storage medium" for computers, but McArthur and others can help us to reframe our thinking in order to see that *all* attempts to record information outside the brain for future use are part of the same human endeavor not only to expand knowledge, but also to put it away somewhere in an accessible arrangement in order to preserve it for later recall.

Writing itself was the first major step in this extra-cranial storage of information. And many of the earliest conventions of cuneiform composition itself such as writing on

a vertical/horizontal axis, pagination, margins, and punctuation replicate themselves in medieval manuscripts and printed books as well as on the computer monitor (Mcarthur, p. 21). Writing and learning for hundreds of years, however, remained the province of those who possessed the skills and owned the tools. The summit of medieval learning and knowledge dissemination was the scriptorium, where monks devoted their lives to the copying of manuscripts and in the process shaped an entire culture (See LeClerq, 1960). From the advent of writing until the invention of movable type in the late fourteenth century, however, learning, specifically the storage and dissemination of knowledge, were the exclusive province of elites, usually members of a priesthood, who were often in the service of political rulers. Not the least of the sources of power in the medieval church was the tight hold ecclesiastics had on manuscripts and their concomitant administrative power over the knowledge contained in the texts recorded there.

Printing changed the logistics of information storage rapidly, and as Eisenstein (1979) has shown, created not only a revolution in the technology of information distribution, but also seminally affected the way people thought and viewed the world. Not only did printing make it easier for larger audiences to have access to information previously stored in scarce manuscripts, the very transition from a manuscript culture to a world where printed books were increasingly common changed the way humans conceptualized the world (Ong, 1982).

While the typewriter was another step in the personalization of writing, the computer represents the next major revolution in the storage of information outside the brain. And like printing, the computer is rapidly changing the way we think about the world and how we interact with each other and our environment (Heim, 1993). In one sense, the computer is but the latest step in the progress of learning and external storage of knowledge, but in many other senses, it represents a quantum leap in human capability:

> The success of print has been so great and so ubiquitous that it has blotted out its own origins, if not intellectually and academically then psychologically. . . . We are poised on the edge of another revolution that could be even more epoch-making than the arrival and application of paper-and-type technology. What comparable effect might not *it* have? (McArthur, p. 70)

Even more so than printing, the computer personalizes information and makes ordinary users the potential rulers of their own information domain. Further, the parallel coupling of computer technology with a worldwide telecommunications network, as exemplified in the global Internet, dramatically increases the speed and permeability of information, ranging from personal electronic mail to massive online databases containing a vast assortment of materials which computer users anywhere in the world can tap into if they merely have access to a telephone.

Computers are significantly different from books in a number of ways however. Books contain primarily text and still visuals (illustrations, pictures, etc.). They are also portable and inexpensive. But the computer is gradually encroaching on the conventional role of the book as a medium of text transmission. The current explosion of CD-ROM and magneto-optical technology has made possible the archiving of massive amounts of textual material on disks no bigger than the conventional music CD. The recent appearance of the electronic version of the venerable *Oxford English Dictionary* on CD-ROM heralds a major symbolic turning point for computerized research (Boletta, 1991b). Computers can link texts in ways that books can by creating non-sequential linkings, or hypertexts (Martin, 1990; Nielsen, 1990). While texts, hyper and otherwise, still remain an important part of many computer applications, however, computers can also store and deliver what are now called “time-based media,” such as sound, music, animation, and video/films. Who knows? Fragrances may be next. While many people think of the computer as a business tool, this emphatically need not be so. Designers, artists, and musicians, not office workers, have probably reaped the computer’s greatest harvest of

innovation. The visionary dreams of poets and artists can become reality on the computer. Baudelaire's *fôret des symboles*, in which sounds become colors, can easily come to life digitally, and Scriabin's futuristic experiments combining music, color, and scents into one artistic performance, are now either comfortably within the realm of execution through the computer or on the near horizon.

Computers can deliver a much more realistic version of the world than books can. Aside from catalogs and lists, books often communicate information in a narrative mode and thus seek through the medium of words to convey a sense of the world through ideas. While also capable, of course, of the same text-based communication, the computer can go beyond the printed or displayed word and can actually simulate or even come close to replicating several varieties of sensory experience. A case in point is the recent currency of virtual reality and the rapid popularization of related concepts that had until recently been the secret knowledge of NASA, defense researchers, and other modern technological priesthoods (Rheingold, 1991).

Virtual reality is a combination of several computer technologies coalescing to simulate an environment or a space that resembles (even replaces!) what we experience as reality through our senses. Anyone who doubts the real potential of this technology (for good or ill) might well take at look at some recent cyberpunk fiction for a view into the very near future, a future that is still to some degree fantasy, but which shows a quite plausible fruition sprouting from the seeds of a technology which already exists today (See McCaffrey, 1991 for a survey of the cyberpunk phenomenon; also Sterling, 1986). William Gibson's *Neuromancer* (1984) is the classic cyberpunk view of the future; his later novels along with the work of Kathy Acker (1988) and J. G. Ballard (1973), among others, show us a future world in which computers have been incorporated into our very physiology much as pacemakers and synthetic arteries already have today. What makes cyberpunk fiction so enthralling (and sometimes alarming) is the fact that much of the technology to accomplish the virtual realities described is either already here or just

around the corner. The postmodern social vistas depicted by Gibson and others are neither lovely nor encouraging. Cyberspace need not necessarily be so bleak, however, and a kaleidoscope of other views exists (see, for instance, the essays in Benedikt, 1991 and in Crary and Kwinter, 1992), yet a Spenglerian sense of dystopian doom pervades both imaginative and scientific views of technology in the future. This sense of an impending technological *Götterdämmerung* darkly tinctures recent films such as *The Man Who Fell to Earth* (Nicolas Roeg, 1976), *Blade Runner* (Ridley Scott, 1982), *Robocop* (Paul Verhoeven, 1987), and *Terminator II* (******), all of which portray several variations on the more chilling possibilities of computer-human interaction in a future that is not so far away. But I digress.

Let us return, then, to our main theme, namely how computers are different from books and how we might most productively take advantage of the computer as a medium of language learning. To summarize, the computer is not a book, though it can serve similar functions. Perhaps the book's greatest advantage, both historically and today, is its portability, but with the advent of laptop computers that fit into briefcases and the availability of hand-held computers such as Apple's Newton and other so-called "personal digital assistants" (PDA's) coupled with an increasingly readable video output, even that salient characteristic of the book may be less than consequential. These and newer, even more portable devices may hasten the long-heralded slide of the book medium into the dustbin of history. Yet today, we often still use the computer as if it were very much like a book and often unconsciously impose the limitations of books onto computers. This should come as no great surprise since transitional technologies often rely on previous models. Gutenberg modelled the typeface of his landmark Mainz Bible after late Renaissance cursive hands used in the copying of manuscripts. Also, the very medium of the book even today shares its format with the Roman codex of many centuries before. It will probably be some time before we humans are able completely to wean ourselves from the book and its conventions, but if recent technology is any

indication, it is happening faster than anyone might have imagined even twenty-five years ago.

Interfaces between Humans and Computers

With the advent of the Industrial Revolution and the growth of urban society, the presence of machines in the lives of everyday people became more and more pervasive. Sewing machines, automobiles, radios, telephones, refrigerators, and a variety of "labor-saving" household appliances were commonplace in industrialized societies by the middle of the twentieth century. One of the problems machines have always presented to their inventors and developers has been their usability. How can one make a complex machine easy to operate for ordinary people with little experience or training? Electronic devices such as the video cassette recorder and a variety of stereo-audio players (turntables, tape decks, CD players) have made this even aspect of machines even more crucial, but the computer has presented perhaps the greatest challenge in this area. Given the ubiquity of machines in our lives today, surprisingly little attention has been paid to the problem of useability. As Norman (1988) has shown, ordinary machines such as refrigerators, can stymie even the brightest user due to the complexity and opaque nature of their controls. The complex knowledge necessary simply to set the time on a VCR has become a stock joke (Kawasaki, 1990, alludes to it repeatedly).

While it is often anthropomorphized beyond recognition, the computer remains, nonetheless, a machine, albeit a rather amazing and exceptional machine. But the computer's main difference from other machines is that humans can program it to do what they want it to do. It is this added degree of software complexity which makes computers both endlessly diverse in their functions and capability as well as maddeningly problematical in terms of useability. The essential problem is this: how can humans know how to use the computer effectively? The earliest computers used vacuum tubes, filled whole rooms, and had no monitors or other input/output devices beyond a teletype-like machine. Many of us still remember the punched tapes and cards that were used in the

early consumer applications of the computer. Nowadays, virtually all desktop computers have monitors, and many have printers, speakers, microphones, and a host of other peripheral devices which facilitate communication between the machine and its user. But as with any machine, the problem is how to bridge the gap between the person and the device.

This bridge is now commonly called the "interface," a jargon term that has gained wide currency both as a noun and verb. Doug Clapp has given one of the best (and simplest) definitions of the human/computer user interface:

"The user is you. The interface is everything between you and whatever you want the computer to do. Generally, it means how information is displayed on the screen, and how information is entered from the keyboard and other devices" (Clapp, 1992, p. 8). IBM-based PC computers, until the recent advent of the Windows interface, would display a cryptic C: or A: on the screen. This is all the users could see, and they would have to know which commands to type in to start an application, copy a disk, or otherwise use the computer.

The conscious concern with human/machine interfaces has a relatively short but pregnant history. There is a linear chain of development stretching from Vannevar Bush's imaginative conception of the "Memex" in the forties (Bush, 1945) to Ted Nelson's visionary ideas about hypertext (a term he invented; see Nelson, 1987) and Doug Engelbart, who originated the "humanist approach to computers" (Tognazzini, p. 293) in the early sixties. His Augmentation Research Laboratory at the Stanford Research Institute (SRI) was the birthplace of the many aspects of computers that are now virtually standard, such as the mouse and windows (see Engelbart, 1986; Engelbart and Hooper, 1988; Fraase, 1992)

Perhaps the most famous and directly influential systematic study of human/computer interface was undertaken during the early seventies at the now-legendary Xerox Palo Alto Research Center (PARC) in California, just south of San

Francisco, the center of the area that has since become knows as “Silicon Valley” because of the proliferation of computer-related concerns which have sprung up there. It was there that interface pioneers such as Alan Kay, drawing on the work of Engelbart, first developed and continued to refine many of the features of computers we now take for granted: the mouse, windows, icons, pull-down menus. Many of the revolutionary interface developments at Xerox-PARC were eventually incorporated into Apple’s Lisa computer, a direct forerunner of today’s Macintosh. The art and science of computer/human interfaces has continued to develop, particularly under the leader ship of Apple Computer, which has articulated more clearly than any other source the considerations underlying good interface design (Laurel, 1990; Apple, 1987 and 1992; Tognazzini, 1992). Interface design has now become a major concern in software development (Schneidermann, 1992; Heckel, 1991)

Computers in Language Learning

The role of computers in language learning is still embryonic, but a number of interested parties are now laying the theorectical and practical foundations for multimedia instruction in the next generation (Ambron and Hooper, 1988; Anderson and Veljikov, 1990; Laurel, 1991; Landow, 1992). No one knows yet what the ultimate contribution of the computer will be. Modes of learning will definitely change, but will educational institutions use computers to control students or empower them? Ted Nelson saw early forms of CAI (Computer Assisted Instruction) as “an attempted paternalism on the part of the schools at best, and at worst, fascism” (Fraase, 1992, p. 168). From today’s perspective, however, it looks as if the most egregious fault of computer programs for language learning is that they might bore students to death by reinventing the wheel *ad nauseam*. By this I mean that many computer programs which claim great to make great innovative leaps actually do no more than duplicate what books can already do better and often rely on metaphors that rarely go beyond the printed page or at best the concept of the audiotape-driven language laboratory, a technology spawned by audiolingual

approach of the 1950's. The problem is often one of interface and a limitation of conceptual breadth, but another shortcoming in many CALL (Computer-Assisted Language Learning) programs is the lack of a coherent approach to developing skills creatively.

I would like to suggest three main principles to guide creators of computer software for language education.

1. Use the computer generically. Don't simply replicate on the computer monitor the contents of a book without any additions or enhancements generic to the computer. This cheats the user in more than one sense. Why should people spend a large sum of money to acquire hardware that simply duplicates what a book can provide for a fraction of the cost. Books can provide text with a great deal of efficiency, but mute text on a computer monitor, while not necessarily bad, often does not take advantage of the computer's ability to add sound or portray material visually. Don't be bound by the sequential organization of a book. Computers permit the user to move non-linearly and go from place to place in a more random manner. Computers can make connections that books cannot accomplish as readily if at all.

2. Allow the user to interact with the computer. A great advantage of the computer is that it can provide responses to the user if asked to do so. Users can give the computer various instructions or make requests, and the computer can carry them out in a number of ways. While the computer remains a machine and lacks significant cognitive skills that humans take for granted, it is quite remarkably fast and can process information in such a way that it simulates certain thought processes. The computer can, for instance, tell you whether an answer is right or wrong according to certain pre-programmed criteria. If you use text or add sound to text, allow the user to manipulate the text in some way by choosing what to hear or when to hear it Allow the user to make choices about the text or to link the text up with other related texts (hypertext links).

3. Guide the user. Computers as a learning tool are still new to most people. Even for experienced computer users, an program that does not clearly tell users what they can do or where they can go can be confusing and frustrating—even on occasion daunting. The user interface, the graphic communication medium between the computer and the user, should make clear all of the possibilities for choices that are available to the user. Users should never have to wonder what their options are and no options should be difficult to discover. By the same token, however, it is important not to overwhelm the user with too many choices or alternatives. Finally, it is important to let users know where they are, how far they have come, and how much material yet remains to cover. In tandem with this, it is sometimes useful to provide some assessment of progress.

Fast Fluency Courseware

Fast Fluency: Communication in English for the International Age was originally conceived as a textbook to be used by students in a teacher-fronted classroom situation. The decision to create computer software based on a textbook that already existed opened up a number of questions. Perhaps the easiest one to answer was which platform to use for designing the program. The Macintosh was the obvious choice, the clear winner in every context. In our experience, it is the best computer there is for multimeda (sound capability was built into even the original Macintosh) and the editing of sound and graphics, both central to our *Courseware*, are a breeze on the Macintosh. Also, a Macintosh system-level extension, QuickTime, made it quite easy to include video clips in the *Courseware*. Our decision was made even easier with the release of the low-priced, high-powered Macintosh LC 520, a computer designed specifically for educational use, with a built-in 13-inch color monitor and CD-ROM drive, plus built in stereo speakers and microphone. We also decided to publish the final work on CD-ROM, dividing the twenty lessons of the book into four volumes containing five lessons each. Following the

growing trend of cross-platform capability pioneered by Apple Computer, we also decided to make the data on the CD-ROM accessible to a Windows environment as well in order to make the program available also to users of PC computers. This is a technical problem we need not go into here, however since it had little or no effect on the design of the *Courseware*.

The primary consideration facing us at the outset was how to create a program for learning English which did not simply duplicate the printed version of the material but which at the same time embodied the pedagogical principles of the original textbook. In other words, how could we make the material in the textbook available in a way that not only enhanced the original but actually transformed it in some way so that it became generic to the computer, taking advantage of the computer's capacity for interactivity through multimedia? An important decision that greatly affected the development of the *Courseware* was that it should be completely autonomous and that users should be able to use it without reference to the textbook. In other words, *Fast Fluency Courseware* would be a program which learners of English in any situation could use without the assistance of a teacher or the need to consult the textbook version. They would only need a computer with a color monitor and a CD-ROM drive. At the same time, however, we wanted to make it possible for teachers and students to use the *Courseware* in a more structured academic situation as an adjunct to the textbook. Thus, while the *Courseware* and the textbook are independent of each other, they each share common material. The each stand alone, but learners and teachers can also use them in tandem.

Each lesson of the book version of *Fast Fluency* follows a uniform format:

Conversation: a dialog illustrating the most common functions of everyday conversation employing authentic, natural language.

Variations: expansions or variations on the key phrases and vocabulary of the Conversation.

Your Turn: Interactive pairwork or practice in small groups using the language and functions of the conversation

Sharing; A short reading focusing on the customs and sociolinguistic habits of English-speaking countries with several topics for small-group discussion.

Try Your Hand: Material for reading and vocabulary enrichment (letters, schedules, word lists, a menu, an employment résumé) accompanied by three short writing exercises.

Given this basis, the first problem was to decide which material to include in the *Courseware* and which to exclude. Clearly any sections which required a partner or a small group could not be taken over bodily into the computer *Courseware*. We decided that **Your Turn**, which called for pairwork or group communication, would not make the transition. That section remains unique to the textbook. Also, the discussion portions of **Sharing** would not work in the *Courseware* version. As amazing as computers are, even with artificial intelligence added, I don't recall ever meeting or hearing anyone who had a stimulating discussion with a computer. I don't mean to rule this out in the future, for technology never ceases to astound me. It is simply not feasible now, and certainly not a possibility on Macintosh computers yet or in a desktop Windows environment.

A clear advantage of the computer over the book medium is the former's ability to deliver sound. The **Conversation** and **Variations** sections were obvious places to introduce sound. Users can choose to hear the entire conversation read by native speaker voices while viewing the text on screen, or they can click on individual names and hear

that line of conversation read as many times as they wish for practice in both listening and pronunciation. Similarly, users may listen to each set of variations from top to bottom or may hear each one individually. They may also hear a variation, record their own voice repeating it, and then listen to both the master voice and their own voice for comparison.

An additional section in the *Courseware* that does not appear in the textbook is the **Listening** section. Additional material based on the lesson content, such as a diary account of events in the conversation and other related material, gives students an opportunity to practice their comprehension skills. They may listen without benefit of the text on screen, or they may click the mouse to see the text. Another new section that appears only in the *Courseware* is the **Test** section. Whenever questions are given, users always have the option of hearing them without visible text or of seeing the text simultaneoulsy. Confirmation of correct and incorrect answers is given on-screen with additional sound cues consistent across all the sections. We will discuss the structure of the tests later.

The real challenge came in deciding how to take advantage of the computer's capacity to be interactive. While the computer's ability to pose questions or respond to inquiries is circumscribed compared to a live human being's virtually infinite repertoire of interaction, computers can do much that books cannot do. Since we had made the decision to omit pairwork, we decided to try to find some way to emulate pairwork with the computer. The best place turned out to be in the variations section. After practicing the variations, both listening to the master voice, recording one's own voice, and comparing the two, the user needs to have some opportunity to use these common phrases in a speech situation. The section called **Test Your Progress** seemed an ideal place to provide such a check. In the Variations Test, users hear a conversational phrase such as "I'd like you to meet Joanne" and are asked to record a response. After they give their response, the master voice again says the cue phrase while it also now appears

before them on the screen. They then hear their recorded response and see a list of the possible variations from the lesson for a check and comparison to their answer. This technique simulates the element of surprise that is present in real conversation, and users have the opportunity to respond to a conversational stimulus without prompting yet can check their responses against a standard repertoire then given on the screen.

Using video meaningfully presented yet another challenge. It seemed pointless merely to include an enactment of the conversation as some recent English teaching software has done. We decided instead to use video in order to demonstrate material which could not be explained as well in words. The natural place to do this was in demonstrating body language and non-verbal communication. We also decided to include a novel form of testing in which students answered questions chosen from categories on a grid and with each correct answer were shown a portion of a picture. After they answer all the questions, the picture, which is in reality the first frame of a video clip, then begins to move and the user must identify what the video show. In the lesson on introductions, for instance, the picture and subsequent video show a handshake.

Most language learning experiences, whether based on textbooks are computers, end in a test of the students' mastery of the material or at least of their progress toward that end. We wanted the *Fast Fluency Courseware* to offer something a little more rewarding than a test, and made the decision to include a short guided tour of famous places where English is spoken. Each lesson contains a series of full-color still shots of cities and localities with accompanying music and narration. Users may choose to see the presentation with or without captions. Not only is the presentation entertaining, it also provides some cultural and historical information as well as giving the user a feeling of participating in a learning experience related to real-life events. As students see views of Victorian houses, the skyline of San Francisco, and stunning shots of the Golden Gate Bridge, they listen to the narration and experience English as a medium of useful communication rather than a set of hurdles to be overcome.

There are a number of other innovations which we have not discussed here, but the above material gives some indication of the kinds of learning opportunities available on the computer which are not possible in books. As more and more institutions make available full-outfitted computer laboratories, and as the price of hardware continues to drop to the level that large numbers of individual users can afford to purchase personal computers with full-color and CD-ROM drives, there will be even more incentive to produce software for language learning. While *Fast Fluency Courseware* is doubtless not the last word, it represents a state-of-the art example of the kind of creative study materials we can design today for language learners employing text, graphics, sound, music, and video and thus taking advantage of capabilities generic to the computer medium.