Multimedia Language Learning: The Pros and Cons

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Abstract

The computer and multimedia learning have come to occupy an important and, indeed, an indispensable place in language and many other types of education. In terms of the former, the most ideal way to learn would surely be under the direct tutelage of a native speaker of the target language whose breadth of knowledge also encompassed developed teaching skills and fluency in the learner’s mother tongue. Optimal exposure to such a paragon, however, will most likely be logistically impractical or impossible, or just too expensive, so many substitutes have arisen to fill the gap, including non-native speakers, most of whom, however, will be native speakers of the learner’s mother tongue; audio and video language tapes and disks; not to mention what is available via the computer and the web. Here it is the last with which we are most concerned. We begin by outlining some of disadvantages and limitations of multimedia and computer-assisted learning, if only to more graphically
reveal and more substantially argue for the overriding strength of their advantages. In their own right, however, these limitations do deserve serious consideration and include an evident increase in shyness and depression, along with a distancing from friends and loved ones who live in close proximity, among heavy users of computers and on-line services. On the other hand, multimedia learning offers a plethora of benefits, from enhanced and more efficient, to more enjoyable and memorable, learning experiences. This leads to an increase in motivation, retention and near and far transfer. Even more promising, when computers offer better interactive—such as sophisticated voice—features, multimedia learning will be even more effective still, and more fun as well.

KEY WORDS: Multimedia, Language Learning, Multimedia Learning, Computer Assisted Learning
The computer and multimedia learning have come to occupy an important and, indeed, an indispensable place in language and many other types of education. In terms of the former, the most ideal way to learn would surely be under the direct tutelage of a native speaker of the target language whose breadth of knowledge also encompassed developed teaching skills and fluency in the learner’s mother tongue. Optimal exposure to such a paragon, however, will most likely be logistically impractical or impossible, or just too expensive, so many substitutes have arisen to fill the gap, including non-native speakers, most of whom, however, will be native speakers of the learner’s mother tongue; audio and video language tapes and disks; not to mention what is available via the computer and the web. Here it is the last with which we are most concerned.

One way of considering the many advantages of online and multimedia language learning is to begin by playing the devil’s advocate and outlining some of their disadvantages and limitations, if only to more graphically reveal and more substantially argue for the overriding strength of their advantages. In their own right, however, these limitations do deserve serious consideration and our discussion of them will be of a more general nature, not confining itself to language learning alone.

**The Cons**

One complaint is that, although computer software is becoming more interactive, or at least allows for more interaction, this type of give-and-take does not necessarily involve another person. In other words, the interaction may be with a thing rather a person. Even a sub-optimal teacher, on the other hand, can be more interactive than a proactive computer program.

The trouble with this argument is that nobody—especially language teachers who recommend and make heavy use of computers and online
learning in their courses of instruction—is suicidally recommending that language programs do away with people and replace them with computers. Computer language instruction is meant to be complementary or supplementary, not necessarily central or even essential, to guided language instruction. If a language learner encounters a problem he (or she) may very well turn to the computer for edification, or a more informed classmate, but the most accessible authority will always be a person whom he knows and whom he trusts to know the answer: his language teacher. Only such a person can, for example, most readily home in on a learner’s problems with pronunciation and most accurately analyze, diagnose, isolate and illustrate what the student is doing wrong, not to mention model how to pronounce a word correctly. Yes, computers are making progress in this direction, but they will most likely never replace the language teacher, one reason being the former are not human, while the latter are, like their students themselves, all too human. We tend to favor creatures most like ourselves, after all. An electric brain (in Chinese: 電腦) may in some ways be like the human brain but it lacks everything else.

Another advantage of the computer as a language aid is that it has the capacity to link us with native speakers whom we would never have access to without it. Email access immediately comes to mind. So too does web-based access. Both of these vehicles, of course, are famous for extending our reach and putting the whole civilized world at our finger tips, even more so than the telephone, and at a mere fraction of its cost. Such access may be unidirectional—we may or may not expect or obtain a response from the opposite party—but a one-way street is better than no street at all. Besides, unidirectional access may be all that is necessary or even desirable.

It was once said that computers would replace books and, indeed, some U.S. schools have even let their libraries fall behind, failing to expand them or even to replace old books with newer versions, instead opting to spend their limited funds on better computers and more diverse electronic
equipment and media. We believe that computers will never replace books, but who says they were meant to? Again, computers and multimedia learning work best as supplementary learning aids, as extensions of book-learning, not replacements. Not all students have computers at home, for one thing, and it's not practical or economically sound for fear of damage, loss or theft, to let them take them home from school.

Further, computers and computer software become obsolete sooner than books, suffer more breakdowns (how much can go wrong with a book?), just don't last as long, and are much more expensive—a borrowed library book is virtually free, a home computer fruitfully virtual, but hardly free. Books, moreover, are edited and reviewed, not so most websites. As Clifford Stoll notes:

Moreover, for every obsolete book, there's a Web site that's inaccurate, out of date, one-sided, or no longer maintained. For all that educators grinch about textbooks (and there's plenty to complain about!) at least someone's reviewed them for content, applicability, grade level, accuracy, and balance. That's simply not true of 99 percent of what's on the Web. Giving students the latest information has little to do with presenting them with quality information or well-organized lessons. ... [Further,] a well-written textbook will last a decade; the poorly written one shouldn't get past the school board. Not true for Web pages and computer programs: Even the best software demands frequent updates. And cruddy programs and lousy Web sites glide right past administrators.

(39)

Stoll makes some incisive points but let us insert a major "on the other hand" here: in some ways we see the internet as the last great hope, i.e., as a prime news source circumventing the censorship and suppression of information by major media sources—many of which are regulated by government (which controls the airwaves over which news networks broadcast and can withhold breaking stories from news organizations which do not toe the official line), and all of which are owned by big corporations
that can refuse to publish information which puts their interests in an unfavorable light. Even the publication of books critical of the interests of corporations that own the publishing houses can be an uphill battle, of which there are ready examples. Regarding such suppression, the name of media mogul, Rupert Murdoch, comes to mind, who has kowtowed to Beijing on a number of occasions. For example, “in 1998, News Corp's book division, HarperCollins, killed a book it had contracted for by former Hong Kong Gov[ernor] Chris Patten [subsequently published as East and West] because it was critical of Chinese officials” (http://www.slate.com/id/2165839/). Thus, the very fact that websites may be unedited and unfiltered can be either a positive or a negative, depending on who is doing the filtering.

Another major complaint by teachers and educators is that computers do a poor job of teaching kids to read and write and develop math skills. Electronic devices may even discourage such literacy. As Stoll complains regarding numeric literacy:

The computer and its kid brother, the hand calculator, work against learning basic arithmetic. They work against appreciating the nature of math. Against familiarity with numbers. Against acquiring an understanding of algebra.

Thanks to digital electronics, students get answers without manipulating concepts: Problem solving becomes button-pressing. It's not necessary to understand how to formulate abstract quantities. Rather, you go straight from numbers to answers. Calculators deliver answers with minimum thought. Confronted by a numeric problem, students naturally reach for electronics, rather than experience. The device first adopted to strengthen mathematical understanding has become a crutch which hobbles the development of numeric literacy. (75-6)

As Harold Wenglinsky of the Educational Testing Service, administrator of the SAT, GRE and other standardized tests, has found:
"The frequency of school computer use was negatively related to academic achievement" (Stoll 84). And sadly, one veteran physics professor only confirms this: "They want automatic answers.... Students can’t stand the manual labor of drawing simple graphs. Or maybe they no longer know how. Either way, they miss out on what it means to do physics.... The best students that come through here are the immigrants whose parents can’t afford computers" (Stoll 86, 88). This is a serious charge!

One mathematician, moreover, with 30 years' of teaching under his belt and winner of the presidential award for teaching excellence, believes that "computers are ruining math education," while Neil Koblitz, another math teacher, has written that computers "drain resources, corrupt educators, work for bad pedagogy and hold a broad anti-intellectual appeal." All this has seemingly led to the tremendous growth in remedial math classes and a decline whereby "two thirds of college math enrollment is in courses which are ordinarily high school classes" (Stoll 89, 88, 90).

A computer is a novelty, a high-priced toy, a kaleidoscopic portal to the world, a window on much that is good, but also much that is bad and ugly. The problem is that children cannot wisely or meaningfully discriminate between these polar opposites. Reading a webpage, some complain, is much more difficult than reading the same content on paper. One friend, a computer jockey himself, has even told us that when it comes to reading off a computer screen, he is almost dyslexic. It takes patience, moreover. There is always the temptation to jump to more exciting material, something more graphic and visually pleasing, more colorful than dull black-on-white print and more animated; or to escape into a computer game, a new song; or something to download, upload, or cut, copy and paste.

The irony of the information revolution is that consumers neither like nor expect long, densely written texts on their computer screens. Long texts addle the eyes; they slow the rapid-fire 'interactive' process, steal
precious screen space from the animation, video, and multimedia's other,
more marketable gewgaws. (Stoll 57)

One may object to these objections by stating that, while paper-
based, deeply-researched articles are being read by those willing to pay for
the journal or magazine in which they are published, one can find deeply
researched articles on the web as well, provided one is willing to pay for
them. One may also find much free information that is still useful, not to
mention well-considered articles which are free but for which the
publishing source may receive monetary compensation—an article
published by an investment newsletter as to why the price of gold will rise,
or one on the many health benefits of the hormone DHEA published by a
distributor of nutritional supplements. That such articles may be biased is
certain, but so are many in print. Again, the reader has to learn to be
discriminating.

There is no doubt, however, that the computer has great distractive
power. Children, not to mention many adult employees, cannot just be
turned loose on the web, or be expected to budget their time wisely and
really produce something unless they will be held accountable. They must
be supervised. But to say all this is only to confess that computers and
multimedia may impoverish by their richness. It is only to admit that,
because electronic media offer such a wealth of riches, one can easily
become enthralled by the flash and splash of a multitude of sound-and-light
shows and forget everything that requires thought. In other words, the user
is tempted to go wide but not deep. Something similar can be said,
however, of many environments, e.g., that of the home, where many of the
same distractions offer themselves, and many different ones as well--such
as the television, radio, CD player, comic book and refrigerator. Children’s
ability to develop concentration and a lengthy attention span can be sorely
damaged, however, if their time at the keyboard is not curtailed. As Stoll
comments,
Dr. [Jane] Healy points to animal research looking at augmented sensory experience and abnormal overstimulation. These studies have shown lasting negative effects on attention and learning. ... Our first few years are of utmost importance in developing motor dexterity and emotional attachment. These are some of the very skills blunted by excessive time on computers (64).

Another serious accusation is that too much time on the computer will impair creativity and the very desire to create. Stoll observes of one teacher:

Ellen Specter has taught kindergarten in Cherry Hill, New Jersey, for thirty-two years. She's seen a sharp drop in children's creativity, attributing part of that to computers: "They expect the visual image to come up before them," Mrs. Specter said. "Everything is instant. They don't have to play. When you ask them to color whatever they want, many will say, 'I don't know what to color.'" (65-6)

Finally, computers, by isolating them, may dissolve the social ties that bond children together at precisely the time they need most to develop human skills and the ability, via negotiation and give-and-take, to get along with each other, not to mention to satisfy the need for human interaction. On the adult level, the latter is most poorly addressed by distance education, which is not teacher-based but technology-based.

Clearly, kids must indeed be guided, learn to discriminate, to think, to be critical, to be skeptical, to challenge, to renounce, even to defy and denounce. This is a crucial part of education. This is part of what it means to go deep. Another part is learning to be innovative, creative, and meaningfully productive. Can a multimedia program help them do all this? Can it help them learn? Can it help them think?

In the case of language learning, there seems to be no question that multimedia programs, by their power to duplicate reality much more closely than printed matter, can act as ideal complements to books and face-
to-face instruction. What could be better to teach reading skills than printed matter or a book? Short of ready access to a native speaker or tutor, learners can hardly do better than with a multimedia program that presents native speakers as an ideal means of self-instruction. As computer programs become more interactive, moreover, the same will be able to be said for speaking skills. Clearly, language skills are acquired best by imitation and repetition. Multimedia simply offer comprehensive 24-7 exposure to these essential processes. As for writing, even here a computer word processing program offers one singular advantage that can be exploited in two ways, one more completely than the other: one can use it either to compose with or merely to key in what has been composed by hand. The extra advantage of the first method, if one can be equally creative in this way, is obvious: it kills two birds with one stone. In either case, the finished, keyed-in product has now become the standard acceptable format for all types of publications.

If computers and the internet offer unlimited exposure to native speakers in a simulated form, however, they may severely curtail exposure of a different sort: to real, flesh-and-blood human beings. Stoll reports that Robert Kraut and Vicki Lundmark, two Carnegie Mellon University psychologists, found "serious negative long-term social effects ranging from depression to loneliness" (Stoll 198) among those who spend too much time on the web (see American Psychologist. Sep 1998 Vol 53(9) 1017-1031).

For their study, Kraut and Lundmark followed 96 families, or 256 individuals for two years. Among the two-thirds completing the study, "the psychologists found an average increase in depression by about 1 percent for every hour spent on-line per week" (Stoll 199). Loneliness increased as well. Most dramatically: "On average, subjects began with sixty-six members in their nearby social circle. For every hour each week spent on-line, this group shrank by about 4 percent" (Stoll 199). Even if we are skeptical about the accuracy of these results, the paradox remains: greater
use of the Internet, a potential tool for enhanced—and a much broader range of—social interaction and communication, results in a decline in social involvement and psychic well-being. Relationships do develop online, but they are mostly shallow in nature and lead to weaker connections with other people: “It’s true that many on-line relationships developed as well, but most represented weak social ties rather than deep ones.... [Most tellingly,] there was an overall decline in real-world interaction with family and friends” (199-200). Stoll concludes with a rhetorical question: “Depression. Loneliness. Loss of close friendships. This is the medium that we’re promoting to expand our global community?”

Optimal social interaction means maintaining strong social ties that help us deal with stress. Such social ties are developed through frequent contact, strong feelings of involvement, close proximity and a broad focus. Contact solely through electronic media does only the first of these, if any. As for the latter three, online contact not only does not advance them, it undermines them: the longer we are online, the less time we’ll have to develop deep ties with those in our local vicinity, those we may see on a daily basis, whether at work or in our neighborhood, and even those we live with at home, thereby undercutting our local, social support networks. Thus, when we face the hardships and crises that all of us encounter at times, we may have no one to turn to, having shunned or neglected those who felt they had a right to some of our time—some of our quality time.

One manifestation of the drop in psychological well-being is an increase in shyness. What’s so bad about that? “Television and computing make us more passive...and passivity feeds into shyness,” says Stanford professor of psychology, Philip Zimbardo (see Stoll 202). More ominously, Dr. Zimbardo warns: “‘Although we think of shy people as passive and easily manipulated, at the same time there is a level of resentment, rage and hostility’” (qtd. in Stoll, 203-4). Again, according to Stoll, psychologists see the best predictor of psychological problems as the lack of close social
contacts: “There’s a surprisingly close correlation between social isolation and such problems as schizophrenia and depression” (202).

In 1978, Dr. Zimbardo found 40 percent of undergraduates answering affirmatively to the statement, “I think of myself as shy.” By 1995, that level had grown to 50 percent. Several reasons for this have to do with technology. Being on-line is hardly a communal experience. With our different tastes in the TV programming we prefer, and since many homes have TVs in different rooms, watching television has become an isolated, non-social event as well. Nowadays, moreover, parents may spend but a few minutes per day talking with their children. As Dr. Zimbardo sums it up: “With more virtual reality overtaking real reality, we’re losing ordinary social skills and common social situations are becoming more awkward” (qtd. in Stoll, 203). Another way of saying it: we have entered the world of simulation and the simulacra where, according of Jean Baudrillard, “the image is clearly an artificial placemarker for the real item.” In this case, among computer nerds, relating to people on-line may seem more and more not only like the way people should and do relate to each other, but also like the way they have always related to each other. Reality collapses into virtuality, originality into imitation, and the age-old order of things is subverted: “the image [or copy] obscures (dissimulates) and threatens to displace the real; third order simulacra are part of our postmodern era; the image is said to completely precede and determine the real, such that it is no longer possible to peel away layers of representation to arrive at some original” (http://en.wikipedia.org/wiki/Simulacra_and_Simulation).

In other words, in order to know how to interact well with people, we have to spend a good amount of time personally interacting with them. In Stoll’s view, “e-mail, telephones, and faxes all prevent us from learning basic skills of dealing with people face to face” (203).

The Asian edition of Business Week (June 5, 2000), in a short feature ominously entitled “The Web’s Chilling Trend: E-time Hurts Real Human Contact”, picked up on this as well:
Already some 36% of users—1 out of 5—spend 5 hours or more online each week, and more than half of these spend more than 10 hours. Meanwhile, the Net is clearly affecting people's social environment. Some 25% of regular Web users indicate that they now are spending less time attending social events and talking on the phone to friends and family, and 13% report reduced face-to-face social and familial interactions. This decline in real human contact is the most worrisome trend the survey uncovered. While e-mail does give people a way to stay in touch, "it's not the same thing as listening to someone's voice or giving them a hug," [Dr.] Nie says. As new generations log on and Web use grows more intense, he fears that the Internet could turn out to be "a powerful isolating technology that undermines our community participation." (14)

But are Stoll and the psychologists oversimplifying here? Emails are essentially letters which get to their destinations faster, albeit without the human touch of the correspondent's personal handwriting. Visiting websites and doing a Google search can be for any purpose from entertainment to shopping to serious reading to research. Are we to suppose that on-line correspondence and letter-writing, that the pursuit of entertainment and something as commonplace as shopping, or as edifying as serious reading or research, can lead to depression or schizophrenia? This would be surprising especially concerning the latter two activities since they are, under normal circumstances, universally done in isolation. In fact, they beg, even demand, that we so do them to maintain the needed concentration.

In other words, one must be skeptical here. Our own suspicions are that on-line activities could lead to psychological disturbances if they result in a mere trivializing of human interaction or of what could be very mind-building events (reading and research), or if one spends too much time cut off from human fellowship. In sum, Stoll and the "shrinks" are right to
warn us of the dangers, for forewarned is forearmed. Thereafter, we must ensure that we maintain a good balance of social and isolated activity, even as we must when pursuing such activities off-line. Moreover, to realize a fortiori the great importance of isolated activity, we need only recall all the great accomplishments, whether scientific or artistic, that have been made in isolation, and that could hardly have been achieved otherwise.

In conclusion, isolated activity is sometimes not only desirable but necessary for the advancement of human achievement as well as for the health of the human psyche. In his The Underground History of American Education, John Gatto points out the need for teachers, educators and parents to let the child be a world unto himself, i.e., to give him a time to be alone with his own thoughts without the feeling of being watched or monitored. The key notion here is: to give children time to resolve their own quandaries and forge their own paths, which he sees as the best method to guide them toward a realization of what they wish to do with their lives. And if constructive, isolated activity is essential, if it is something we should encourage and foster in the young, can we legitimately contend that there is something in the nature of such activity when done on-line that leads to negative psychological consequences? This seems highly doubtful and more research is called for. Where we do agree with Stoll and the psychologists, however, is in the contention that children are best guided by responsible adults in their on-line pursuits. Not to do so when they are faced with such a feast of on-line riches is like leaving Hansel and Gretel unattended to devour the gingerbread house.

Let us now look at the many benefits learning languages through multimedia can offer.

The Pros

In fact, it can be argued that not only have computers increased the efficiency of learning, they have improved the quality of its results. An ideal use of the computer and the Internet really does further learning in
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more ways than one, as we intend to show by leaning heavily on the third edition of Stephen Alessi and Stanley Trollip’s encyclopedic Multimedia for Learning.

Learning Principles/Approaches

Even if it could be contended that computers do not improve the quality of instruction, that they do reduce the time spent learning is a real benefit (see Christmann et al.; Kulik & Kulik). This is not to say that multimedia outperform low-tech media in all subjects—in fact, no single medium is ideal for all learners, all topics and all situations. Nonetheless, there are situations where the computer is likely to be more beneficial, and these include those in which costs, safety, subject complexity, extensive individual practice (e.g., foreign language study), learner motivation, logistical difficulties or special learner needs require special consideration.

Other factors that might decide one’s choice of medium include ease of perception (e.g., listening to music is usually preferable to reading a score), repeatability (e.g., foreign language tapes), and pace (adjustable speeds for L2 videos). Overall, the ability to make continual adjustments to text sizes, colors, fonts, backgrounds, music and motion images not only draws more learner attention but offers the opportunity to provide more efficient and up-to-date instruction as well.

Another advantage to multimedia learning derives from the principle of dual coding and the so-called multimedia effect: “Dual coding theory suggests that learning is enhanced when complementary information codes [or multiple symbol systems, e.g., an equation— —which is also displayed as a graph] are received simultaneously” (22), such as via video and narration. According to Richard E. Mayer, however, who has used the term multimedia effect, “some combinations complement one another and facilitate learning, whereas others conflict and impede learning” (Alessi & Trollip 22). For example, the sixth of Mayer’s seven principles of multimedia design, the redundancy principle, states: “Students learn better
from animation and narration than from animation, narration, and on-screen text.” The fourth, the coherence principle, states: “Students learn better when extraneous words, pictures, and sounds are excluded rather than included” (Mayer 184). In choosing her combinations wisely, an instructor or designer can enhance comprehension as well as recognition or recall.

Interaction between user and multimedia programs is certainly one of the most outstanding and rewarding features of such programs. Interaction not only engages learner attention, but helps create new knowledge and skills as well as facilitate comprehension. Ironically, although “one of the essential features of interactive multimedia, in contrast to more traditional media, is its capacity to require learner actions and to act on them” (24), it is precisely this characteristic in which much commercial courseware is most lacking, primarily because designing interactions that are frequent, relevant, interesting, and at an appropriate level of difficulty is no easy task. Finally, let us not forget such interaction need not be confined to human-to-computer interactions but may be extended to include human-to-human, human-to-paper, and human-to-computer-to-human interactions (networking) as well.

At this point we need to give a more detailed breakdown of the factors that generate learner motivation, one of the most important enhancers of all types of learning. Psychologists have long divided motivation into two types: intrinsic and extrinsic, with the former regarded as far and away the more ideal of the two since it means the learner is willing to apply herself to learning out of personal interest or fascination or, even better, a real passion for the subject of study. Extrinsic motivation, of course, is generated by all the extraneous rewards contingent upon submitting to such study, from better grades to a brighter future. Instructors often use extrinsic motivators in that few learners can be depended on to possess the right intrinsic ones but, ideally, these extrinsics will be employed with the idea of weaning students off of them while seeking to generate or stimulate the intrinsic ones. In other words, instructors should seek to build up student
interest in their studies. Few of them would disagree with this, to be sure, but the question is: how best to do that? And, for us, a related question is: how to get multimedia to do that?

Lepper has suggested certain techniques to enhance intrinsic motivation and make learning more fun; to these we have added a few ideas of our own: use of game techniques; use of different media and embellishments, e.g., visual techniques, sound effects, etc.; creating exploratory environments to create a sense of drama, mystery and adventure; a high degree of learner control; challenging the learner; arousing learner curiosity; giving encouragement after errors are made; giving compliments when appropriate; and delivering a brief pep talk or inspirational message on occasion.

For an anatomy of motivation enhancers, both Malone and Keller have posited theoretical models, each consisting of four elements. For Malone, challenge, curiosity, fantasy and control are all key factors. One example of challenge is something a good multimedia program can do very well: increase the difficulty of its content with improvement in learner performance. As for curiosity, Malone distinguishes between sensory and cognitive curiosity, the former generating interest in new or surprising visual and auditory effects, the latter in information that is arresting, incomplete, or that contradicts or conflicts with the leaner's expectations or existing knowledge. Fantasy fires the imagination, encouraging learners to envision themselves in other times, places or situations. Simulations can do this very masterfully.

Regarding user control, Malone offers three rules: contingency, choice and power. To meet them, programs must give feedback as a function of learners' responses while providing them with menus, branching options and, when merited, "powerful effects", such as when learners are prompted to create a computer graphics program as a team effort.
Although a generous degree of control will be beneficial for some learners, for others it may be a stumbling block. In fact, its effects on motivation and learning are complex (see Hannafin & Sullivan; Lawless & Brown; Milheim & Martin; Steinberg). Generally speaking, higher achievers will benefit from greater control, whereas lower achievers from less control lest they be allowed too much freedom to generate poor decisions.

Keller uses what he calls the ARCS model of motivation design: attention, relevance, confidence, and satisfaction. Here we will limit ourselves to a few brief remarks. Multimedia are attention-getters, par excellence, even to a fault, since they can offer a visual or aural feast which, if not well integrated with substantive content, can degenerate into sources of diversion, digression or distraction. Relevance, of course, means learners see the content as being relevant to their needs. Tutorials, for example, help learners understand this connection when they begin with a concise statement of their goals or objectives. Simulations, above all, have been found by most learners to be more relevant to their learning needs than lectures or books because users are engaging in an activity they would otherwise just hear or read about. Confidence can be instilled by incorporating into the program appropriate levels of difficulty—gearing the lesson to the learner—as well as suggestions and hints, and suitable learner control; satisfaction by including encouraging and supportive feedback and recognizing learner achievement when they have successfully completed a lesson or advanced to a higher stage, or else been led to apply what they have already learned.

We now turn to mental models. Cognitive psychologists consider these to be critical components in developing knowledge and expertise. A mental model, as the term implies, exists in the learner’s mind, i.e., it is an internal image which structurally parallels the real phenomenon and which is useful on a short-term basis. The key point here is: since learners may not develop them on their own, designers would do well to assist them in the
formation and proper refinement of such models by providing conceptual models.

Computer diagrams, animations, and video presentations have all been suggested as means of providing conceptual models that help develop learners’ mental models. This suggests that multimedia technology, with its excellent capacity for animation, diagrams, and the like, has great potential for developing mental models. (Alessi & Trollip 28)

It has been recommended that teachers and program designers pay as much attention to learners’ metacognition as to their cognition. Metacognition refers to the learner’s awareness of her own cognition and is important because it well behooves learners to have a good assessment of what they already know and what they yet need to know. In fact, regarding cognition and metacognition, learners may be high in both, low in both, or high in either of the two and low in the other. High achievers are generally high in both. Multimedia programs can assist by including reminders to stop and ponder, self-assessment aids, collaborative learning aids that help one partner assess the other, and practices to develop metacognitive skills. Happily, these skills can be applied to virtually all content areas so that “if multimedia programs include features to improve learners’ metacognitive skills in one content area, they also improve learning in others” (29).

Though good metacognition can lead to not only better self-assessment but improved performance as well, the same cannot be said for high self-esteem, which does not necessarily lead to quality performance in school, no more than does low self-esteem inevitably lead to poor performance, as the following example shows:

But when Chinese and Japanese students were segregated by law in California in the early twentieth century, they outperformed white students. Why weren’t they overcome by a lack of self-esteem? Still
other studies have shown that no connection exists between self-esteem and educational performance. For example, in a study of mathematics skills among thirteen-year-olds in various countries, Koreans came in first and Americans last. Yet when asked if they considered themselves "good at mathematics," only 23 percent of the Koreans did. But two-thirds of the American students said they were good at math. American students had lots of self-esteem, but less mathematical knowledge than any other country surveyed. (Woods 197)

Needless to say, good metacognition by the American students could have led to better preparation ahead of time, and less shock after the fact.

Software Learning Features

Credence in the efficacy of software features that promote learning gains force from this statement: "It has long been suggested, even before the existence of microcomputers, that learners may be able to make better sequencing decisions about their own learning activities than can teachers" (Alessi & Trollip 81; and see Bruner). This remark can serve as the basis of an argument for software designed to afford liberal use of user control, and even user modifiability, both for practical and pedagogical reasons, as in passive bookmarking as a means of allowing learners to pick up where they left off in a previous session. As we discuss below, allowing users modifiable exposure to speech, graphics, sound, animation and color makes language learning not only more enjoyable, but more efficient as well.

Most would agree that graphic presentations greatly enhance learning, especially when spatial relationships (diagrams, charts, maps) are key factors in the learning process, or when procedures are learnt best when visually depicted (as in modeling). Further, "animations are good for depicting processes in a simplified or abstract way (Hays, 1996), and a computer can do this better than most other media" (Alessi & Trollip 62). The visual depiction of how the tongue and lips move to pronounce certain
phonemes of the L2 is an obvious example. Accompaniment by the sound of the phoneme itself would make this a combination hard to beat by any pronunciation textbook, though there is every reason to invite the textbook to the party, i.e., use it in conjunction with the accompanying software. Graphics also have the blessing of conveying “a thousand words” in one picture, which makes them ideal for beginning learners who need to quickly pick up on ideas and procedures without getting bogged down in more text.

Further, often graphics are not only ideal sources of primary information, but do good service in the use of cues and organizers, analogies and mnemonics. Animation is also an effective marker of significant change, especially when used in combination with optimal user control: “Use animation when dynamic change is important and allow the learner to pause, continue, repeat, and in some cases control the speed of change” (Alessi & Trollip 72).

Video is a natural choice for such language learning activities as conversation practice. Swan has shown that “information presented by video may be more memorable due to its visual detail and its emotional impact” (Alessi & Trollip 73). This is true in spades if we give credence to dual coding theory, whereby “complementary forms of information, such as a picture and speech describing it, facilitate learning more than a single form” (Alessi & Trollip 62).

Sound is necessary, of course, in language learning and works well with visual presentations and without text. And we have already seen that Mayer recommends animation and narration without on-screen text (see p. 10 above). Alessi and Trollip foresee great changes in computer use with the development and refinement of speech technology, predicting a “dramatic increase in acceptance and use of computers by many more people” (60). If, by this, they mean the ability of the computer to respond to and key in human speech, we cannot but agree.

As for color, though it is usually thought of as more ornamental than functional, there is evidence that it enhances learning and motivation. (see
Dwyer; also Pett & Wilson) For one thing, like sound it can draw attention to important information and efficiently emphasize differences. Books are often devoid of color so as to keep down expenses and thus their price, which helps explain why some people don’t take to books.

As with drills and tutorials, a generous amount of learner control is optimal and there is good reason to believe that such control is more beneficial when feedback as to learners’ progress and the success of their decisions—e.g., the percentage of questions answered correctly—is forthcoming.

Other features, such as progressive menus, help orient the learner. Rollovers, a kind of help on demand, supply extra information or clarification when the learner points at something, such as an icon. They are often ideal helpers because they are so unobtrusive; if the user does not seek information, it is merely a matter of not pointing.

Finally, we should keep in mind the specific goals for which different instructional tools are designed: tutorials for initial learning; drills for retention; and simulations for transfer (of knowledge from an instructional to a real-life environment).

Tutorials

The great thing about computer tutorials is that, like e-drills, they can be made adaptable to the individual learner. Alessi & Trollip elaborate: “The program judges the response [to a question] to assess comprehension or skill, and the learner is given feedback to improve comprehension and future performance” (89). Just as important, a program can make sequencing decisions to ensure that what follows will be most suitable for a learner’s level of knowledge as determined by his previous responses.

The simplest type of tutorial, being linear in sequence, does not exploit the computer’s rich resources, nor adapt itself to individual learners but, instead, offers the same presentations, order and questions to all regardless of whether these questions are answered correctly or not. With
so-called branching tutorials, on the other hand, the sequence is influenced by learner performance and choice, making them far more effective. Accordingly, branching may move in three directions: forward, so that a learner skips information other learners need to see; backward, whereby the learner is made to repeat instructions; or sideways, so that the learner is exposed to information that other learners normally skip. In the first case, the learner chooses to skip to the next sequence; in the second, she has not answered the questions adequately and must repeat exposure to information and answer the questions again; in the third, when the learner answers incorrectly, new information is presented.

As for the questions themselves, they should test comprehension, not just recognition and recall. Substantial research has already shown that questions do facilitate instruction (see Anderson & Biddle; Hall; Hamilton; Wager & Wager). However, they do much more than this: “They keep the learner attentive to the program, provide practice, encourage deeper processing, and assess how well the learner remembers and understands information. Last, by virtue of assessing recall and comprehension, questions provide a basis for program sequencing” (Alessi & Trollip 94). In fact, frequent use of questions, i.e., at short intervals, has been shown to keep learners more attentive and more engaged.

The responses to these questions can guide the program in offering the most appropriate feedback, which need not be solely answers, but may include hints, information, and advice. Thus, if a response is correct, a short affirmation can follow; if incorrect, a hint or corrective feedback may be offered. If the response format is incorrect, this should be stated and another response allowed. In any case, feedback in tutorials is best when it is immediate, while still allowing the learner a few attempts at giving the correct answer, unless he actively solicits it. In sum, “a tutorial should give the correct answer after a reasonable number of attempts, should provide assistance such as hints, and should permit the learner to request the answer” (Alessi & Trollip 119). Even if her answer is incorrect and she
does request one, the learner should be allowed to proceed with the tutorial regardless.

Finally, tutorials need not be designed for just one learner at a time. Interaction between learners certainly has its appeal and may be even more effective.

Programs may assume two learners working together and promote interactions between the learners, such as asking each other questions and discussing answers. Another technique is for the computer to ask an open-ended question, have one learner answer it, and have the other learner judge whether it is correct and enter their answer into the computer. The second learner acts as the eyes and ears for the computer—allowing complex responses and storing or branching based on results. (Alessi & Trollip 109)

And in web-based tutorials, learners may cooperate even if they are at different locations.

Tutorials are another great learning tool that computers can offer learners. With their program menus, text search and bookmarking features, they should always be considered, by instructor and student alike, as an ideal way of reviewing already presented material as well.

**Drills**

Drills are not the most popular language-learning activities among language students. Many learners of foreign languages seem to find them too often dull, tedious and too repetitive. And since their content is devoid of any authentic connection to real-life content, one might question the ability of the drill to be memorable enough to foster retention and, by extension, transfer, both near and far. Nonetheless, drills have been shown to be effective, if rather unremarkable, language-learning tools.
The good news is that good computer software can produce effective and more interesting drills than those on paper. The secret is to have the program monitor the learner's progress, or lack of it, and then adapt the drill to it accordingly so as to enhance learning.

From the start, we should keep in mind that drills do not have to confine themselves to strictly textual information. On the contrary, they may work with auditory, visual and numeric data as well. Examples that can be adapted to multimedia language learning include:

- auditory to text: hearing Chinese and selecting or typing the English
- text to pictorial: reading a bird name [in L2] and selecting the matching picture
- pictorial to text: seeing the bird picture and typing or selecting its name [in L2]. (Alessi & Trollip 185, adapted)

Such variety is more likely to ensure far transfer, or the ability to apply what is learned from the drill to multifarious real-world activities.

As to the design of the software itself, the following should be borne in mind:

**Evaluating.** Since well-designed drills offer corrective feedback and branching or queuing, learner responses must be constantly judged throughout the session. Corrective feedback offers a correct response to counter the learner's incorrect one, or at least a hint to guide him toward the correct one. Branching takes him in a certain direction based on his past responses, thus towards more difficult questions after he has successfully answered easier ones. Queuing, as we will soon show, again bases future selections on past performance. The above features can be incorporated into a foreign language book only clumsily or with difficulty. Computer software has the added advantage of enabling the effective use of graphics to give hints, report on the learner's progress, present feedback and spark learner motivation.
**Hints.** These have clear advantages. They may increase motivation as well as memorability, in the latter case by associating, for example, a vocabulary word with a pertinent hint to which, ideally, it will ever after be associated in the mind of the learner, such as the word (for) “cat” with a picture (the hint) of the same animal.

**Queuing.** Drills are not drills without repetition. In fact, the heart of learning any skill is repetition, or, to use a music analogy: variations on a theme. Repetition, of course, enhances recall, ideally until the L2 gets into the language learner’s “bones”—until, as the song lyric goes: “it’s second nature to me now.” A standard way to teach, say, vocabulary is via drills based on random selection. However, this method is inefficient, because it’s not geared to the individual learner, but to any and all learners. A much better method uses queuing to give learners more practice with the vocabulary words that they don’t know, confuse with the meaning of other words, or keep forgetting. Queuing entails presenting words in a systematic way based on the learner’s past performance. Thus, when a learner responds to a vocabulary word correctly, she will encounter it less often as the drill proceeds until, finally, the program will assume it is familiar enough to be retired, i.e., removed from the list. Conversely, when she responds incorrectly, she will encounter the word more often, until it becomes more familiar and can eventually be retired. As Alessi and Trollop note, “computer programs that use this procedure can increase the frequency of repetition for items that are incorrectly answered, thus providing more practice than with random selection” (190).

One example of this method is called Variable Interval Performance Queuing, which positions words in the “future queue” list according to how they are responded to in the present list. Thus, when an item is answered incorrectly, it is queued at a certain number of new positions. The future queue is constantly changing according to how previous items are addressed. Again, speed of response can be one criterion, along with
accuracy. Another option is to bring the word out of retirement if it has been answered incorrectly in the past to ensure that its meaning has been well embedded in the learner’s mind. Finally, any words that have not been retired from a limited list in a previous lesson or session, can be carried over to the next lesson for added practice and reinforcement.

The queuing method can also distinguish discrimination errors as well as between within-list errors and out-of-list errors. A discrimination error is caused by confusion between similar items, such as pero (but) and perro (dog) in Spanish, or the verbs lay and lie in English. A within-list error is a response that is incorrect for the item presented but correct for some other item on the list. An out-of-list error is one that is not correct for any item on the list. These distinctions are useful because, when the learner makes a discrimination error, he can be immediately presented not only with the correct response for the item presented but with the L2 word (and its translation) with which he is confusing it, thus:


Queuing can be readily seen to be an ideal and optimally efficient way to set up drills. On paper, the closest equivalent is flashcards, wherewith a learner can remove items whose meanings are familiar and position items whose meanings are not, so that they appear sooner, and again and again. With the right computer software, the program can do it automatically, and offer graphics, sound and animation, to boot. Add some imaginative motivators--such as “You’re on the way”, “Way to go!”, “You’re halfway there!”, “You have only ten items left to answer”, “Congratulations, you’ve now answered 100 items correctly in this session!”, or even “You got this one right the last time. You’re slipping, what gives?”--and learning becomes not only more efficient but more human, interactive and fun. Even extrinsic motivators such as these may serve a real purpose here.
Overall, queuing and the above enhancements, including motivational and even inspirational or challenging feedback, can make computer drills superior to any other form of drill, and as rewarding and friendly as a drill can possibly be.

The sophisticated queuing methods possible on a computer, which emphasize practice on difficult items, have great potential for increasing drill efficiency and effectiveness. These methods are practically impossible to implement using flashcards or workbooks. The computer's computational power makes them possible and its unfailing memory makes possible the periodic review of retired items. This too is difficult or impossible with non-computerized drills. (Alessi & Trollip 209)

Another way that computers have proven useful in games, simulations and drills is through their ability to serve as an opponent so as to enhance motivation. "Competition against the computer has the advantage of allowing all learners to succeed and receive reinforcement." As with games, the difficulty level can be adjusted so that even beginners have a chance to outscore the ghost in the machine. "In this way, a drill program can motivate each learner to work at his or her best" (Alessi & Trollip 204).

On the other hand, a computer may serve as a partner in team competition while serving as scorekeeper, to boot. Support and help from a teammate, whether man or machine, can be both motivating and conducive to learning. So can such multiple modes of presentation as text, graphics, color and sound.

If the drill comes in the form of a game, other motivators may be employed as well. "Games use not only the previously discussed drill motivation techniques (competition, goal setting, scoring) but also additional ones, such as fantasy, surprise, uncertainty, and even relevance. (Children consider games a relevant part of their lives)" (Alessi & Trollip
To be an educational game, winning must be closely linked with accomplishing the learning objectives.

Finally, a drill should not be presented as an endless continuum, with no end in sight. Rhetorically, we ask: what could be less motivating than a drill that never ends? Rather, drill sessions should be short and with realizable and relevant goals.

In sum, well-designed computer drills offer many or all of the following motivational features. They...

- allow the learner to request help.
- allow the learner to see the answer upon request.
- give corrective feedback when a response is incorrect.
- may use game features, e.g., scoring, competition, cooperative learning.
- set reasonable goals.
- report progress.
- vary displays and responses.
- provide reinforcement.
- keep drill sessions short.

**Pacing and Distracters.** Speed can be of critical importance for the active language skill of speaking because in real-life situations requiring use of these skills, a reasonable speed of response is expected by our interlocutors, while, as for listening, speed of comprehension is often absolutely necessary for good understanding to occur at all. Few have the patience either to stand idly by while you, as speaker, wrack your brain searching for a way to make yourself understood, or to constantly repeat themselves at your request. As the learner advances, drills will, ideally, test, vet and evaluate speed as well as accuracy of response.

Moreover, real life often bombards us with distractions, such as the ringing of a telephone when we’re engaged in conversation with someone, a pretty girl passing by, the roar of an airplane or the bark of a dog.
Including realistic distracters in drills is a way of challenging our comprehension and concentration with distractions that we often have to face when communicating in real-life settings. Here, too, computerized drills can test learners in ways that printed drills cannot by using sounds and animated images inaccessible by texts.

Tests

Although some language learners may suffer from computer anxiety, viewing it as an incomprehensible alien object, generally people's reactions to computer-administered tests is positive provided the program is well-designed. One reason for this is that test takers like the immediate feedback such programs can offer. “When asked, most people indicate that they would take and would recommend taking exams via computer rather than by conventional paper-and-pencil means” (Alessi & Trollip 338; see also Wise & Plake 1986 and 1989). Trouble is, in the past too many computerized tests did not allow students to change their answers, thereby heightening their anxiety. For some it was a matter of test anxiety compounded by computer anxiety!

On the contrary, users should enjoy maximum control, i.e., it is the examinees (or instructors) who should decide what to work on next rather than the program. Such control is the best way to minimize anxiety. “An example of this would be allowing the examinee to answer items in any order or to change answers to items” (Alessi & Trollip 344). Another is the option of reviewing the test directions and previous answers at any time. In the latter case, the test program should “provide the capability for the examinee to tag any item for later review, similar to creating a bookmark. If that capability is provided, the examinee should be able to access these marked items easily without having to cycle through the whole test item by item searching for them” (Alessi & Trollip 350).

As with drills, speed of oral response should also be given weight in measuring fluency. Other features might include providing a list of
unanswered items or of those bookmarked for review so as to allow the examinee to return directly to these items without requiring her to waste time searching for them. Room should also be left for comments by the examinees. The time remaining should be well displayed. Questions and their answers (as in multiple-choice items) should be totally visible on the same screen so the examinee does not have to scroll up and down when comparing parts of the same item. Finally, if there is a breakdown or the computer should fail in the middle of the exam, there should be a means of restarting the test without loss of information and with the same amount of time remaining.

In sum, then, a good test will adhere to the following three principles: a) user friendliness, b) maximum user control, c) safety barriers and nets, which are mechanisms that make it difficult for the examinee to do something accidentally (short of selecting the wrong answer, that is). The ideal is to take as model the degree of control enjoyed by examinees of paper tests and, in some cases, to even go beyond it (e.g., as with bookmarking).

**Simulations**

Jean Baudrillard has written extensively on simulacra, or human creations— inventions—that simulate reality to the point where they become reality—a new reality—prompting the disappearance of the old way of doing and thinking. How many restaurants can you enter today and get a real glass of fresh-squeezed orange juice? Usually, either it won't be orange juice at all—merely a cheap imitation—or part of it will be the real thing but none of it fresh, but frozen, until the young and those with short memories are led to believe the imitation product is the real thing, nor was their ever any other. Welcome to the world of simulations.

With computer simulations, however, the idea is not to replace the real thing but to prepare the learner for it, the most recognizable example being flight simulators.
“Simulations are perceived as more interesting and motivating than many other methodologies, a better use of computer technology, and more like ‘learning in the real world’” (213). Can there be a better way of learning than this, a kind of “on-the-job” training? Like a good book or film, simulations can pull the learner out of his real-world environment and transport him to the ideal-learning world of simulation. Why it is ideal has to do with why an instructor or learner would want to turn to a simulation in the first place. Unfortunately, not all learning goals can be met by simulation exercises, but these do deserve wider application.

“Simulations can enhance safety, provide experiences not readily available in reality, modify time frames, make rare events more common, control the complexity of the learning situation for instructional benefit, and save money” (Alessi & Trollip 226). In a history course, for example, students cannot witness events that will never recur, but they can view reconstructions of them. Simulations can also manipulate time, making slow or quick events (the flow of a glacier, the beating of a hummingbird’s wings) speed up or slow down, respectively. In ESP (English for Specific Purposes) instruction, simulations can model good use of diction, vocabulary and intonation in service to the interests of the user. Simulations can reproduce rare events, such as airplane mishaps and malfunctions, to train learners in the best way to handle them. Finally, they can simplify complex systems or occurrences, progressively adding new layers of complexity as the learner’s understanding increases. As can be seen from the above, simulations are sometimes the only way of properly instructing learners in events that cannot otherwise be (re)produced, so as to make them less confusing and more controllable.

Simulations have a number of advantages over more traditional media and methodologies. First, they are, unsurprisingly, more motivating. Both Keller (1988) and Malone (1987) have broken down motivation into what they see as its main constituents which include challenge, fantasy, relevance—and interactivity, reputedly one of the most beneficial aspects of
multimedia learning. Simulations do well at stimulating learner engagement with all of these. They can (re)create interesting, even fantastic settings, environments, scenarios and storylines, and progressively increase difficulty to challenge the learner as her knowledge and skills advance. As for relevance and interactivity, "most learners consider simulations more relevant to their learning than lectures, books, or other more passive methods, because they are engaging in the activity rather than just reading or hearing about it" (Alessi & Trollip 229).

Second, they facilitate near transfer of learning. Again, this is unsurprising since they mimic real-life situations and elicit responses that the learner would actually make in those situations, as Stephen Culhane has done so well in his home-stay computer program. Even far transfer can be facilitated by introducing a variety of visual and auditory stimuli, as well as of situations and activities.

Third, well-designed simulations do seem to foster time efficiency in that, whereas the same results may be obtained through, say, a series of lectures, on the one hand, and a computer program, on the other, the lecture series takes ten hours and the latter, as a simulation combination, only five. "That is, more transfer occurred per unit of learning time with the simulation than with the lectures" (Alessi & Trollip 230; and see Detterman & Sternberg; Yellon).

Fourth, simulations are highly flexible and adaptable to a broad spectrum of learning approaches. They may be used as tests and instruments of assessment (see Alessi, 2000), and as drills when practiced repeatedly. They are one of the few methodologies embraced by advocates of all manner of learning principles, whether behavioral, cognitive, constructivist, instructivist, any or all of which can be highlighted or combined in a simulation. Thus, "a simulation may provide extensive learner control or may be directive and program controlled. Simulations provide designers with far more options and decisions than other methodologies" (Alessi & Trollip 231). In fact, situational simulations
usually entail an equal payoff of both model and user action and reaction. The learner is not meant to be just a human sponge but an active participant. By making choices and decisions, taking notes, composing and reconstructing, controlling and duplicating, the learner advances in knowledge and skill, for such interactivity should "promote deeper processing of the information being learned" (Alessi & Trollip 426).

Ironically, in manipulating time for pedagogical purposes, simulations reduce fidelity to the real-world phenomena they seek to imitate. Nonetheless, "modifying the time frame can decrease boredom, improve time efficiency, accentuate critical events, and clarify the big picture" (Alessi & Trollip 241).

Increasing fidelity, on the other hand, such as by decreasing instructional supports, may enhance learning transfer, as with dynamic fidelity, whereby the difficulty level increases with the learner's advancement in skill and knowledge. Beginners, to be sure, prefer artificial feedback that makes things easier to interpret and that is more positive in tone, whereas advanced learners will be more motivated by natural feedback (of the kind they could expect in a real-life situation), which by nature is high in fidelity and fosters good transfer as well. We should keep in mind, however, that perceived fidelity is often more motivating and pedagogically effective than actual fidelity. In advanced language simulations, a primary goal should be faithful modeling of human behavior, which can be very complex and sometimes hard to predict.

Let us remember that simulations are a good choice when we seek programs that adapt themselves to learner performance, or if the content is too expensive, unsafe, uninteresting or difficult to teach in another way. In conclusion, we can say with confidence that

Simulations improve on tutorials and drills with enhanced motivation, transfer of learning, efficiency, and flexibility. They have the advantages of convenience, safety, and controllability over real experiences; provide
a good precursor to real experiences; and are useful for giving learners experiences that are not otherwise possible. (Alessi & Trollip 263)

Web-Based Learning

"Use of the Web will probably have more impact on learning than all the developments in instructional technology of the past thirty years. The Web may also facilitate the accomplishment of many of our old hopes about effecting educational change through electronic technology" (Alessi & Trollip 372).

We need not wonder why so many have woven such wild, weighty and wonderful dreams about instruction via the World Wide Web. Its global reach, easy access, platform independence, wide acceptance, marginal cost and multiple possibilities make it one of the most significant innovations of modern times. Indeed, it is a learning forum with which it is hard to compete, one reason being that it is largely unfiltered, uncensored, universal and so direct. One may publish information one hour and make it accessible to millions the next. And, in countries whose academic means of instruction are dominated and largely controlled by public education (just about everywhere) not having to answer to government censorship or jump through Uncle Sam's hoops is no small consideration. So it is no exaggeration to say that it may one day offer us the staunchest shield against tyranny (and see above, p. 3).

Still its strongest link is also its weakest: the fact that it is largely unfiltered is an invitation to all manner of abuse: hoaxes, deceptions, plagiarism, misinformation and just plain lies—in short, lack of quality control. Happily, in language learning, and learning in general, we seldom need concern ourselves with these: most online instruction has no reason to deceive and is sophisticated enough to be accurate. And, for language learning, one can always fall back on native speakers with linguistic expertise for confirmation and support. Since web-based learning may not
only effectively do away with distance and isolation but also, paradoxically, exacerbate the learner’s sense of them, learner access to instructors and other resource people is a must. And in the schools webmasters and other computer technicians must be on institutional call to maintain and repair systems.

Even more so than with other multimedia methodologies, a web-based one invites, and often compels, collaborative learning. Much research has proven its pedagogical value so, here, we need only remind the reader that “collaborative learning activities...can facilitate motivation, social learning, metacognition, equity, and achievement. For on-site learners the Web can enhance the usual methods of meeting and collaborating. For distance learners the Web may be essential for collaborative activities” (Alessi & Trollip 381).

Indeed, one of the most enriching aspects of web-based learning is its capacity for interactivity. Unfortunately, many websites fail to exploit such capability, with the result that “the interactive potential of the Web is hardly being utilized at all. Instead, the Web is being used largely as a file storage and retrieval system” (393). Part of the problem stems from HTML, the underlying language of the web itself. Whereas it does support navigational efficiency, “it does not provide good support for typing words, dragging objects, or pulling down menus. It provides no support for speaking or response judging” (392). Further, the Web does not facilitate storage of data necessary “to keep track of responses a learner has given, the sites a learner has visited, or choices a learner has made” (392). Since, in our view, interactive learning is of critical importance no matter the methodology or content, restricting the Web’s rich instructional potential to the presentation of material alone strikes us as a gain surmounted by a loss. To this can be added the failure to maximize its potential as a synchronous forum integrating learners into a real-time environment for optimal development of language and other skills.
For foreign language education, the Web's international capabilities make it an attractive platform uniting distance with on-site learners, and people of divergent ages, abilities, backgrounds, experiences and outlooks, not to mention natives with L2 learners.

The exponential growth of the Web and in the number of Web users is testimony to its tremendous capacity to reach large, even remotely-located, users on a round-the-clock and a cost-efficient basis. Once its rewarding potentials become more fruitfully exploited, "the Web may indeed be the critical application that brings computer technology into the mainstream of the educational enterprise" (399). Or is this statement already outdated?

Hypermedia

Frankly, we prefer reading from a book to reading off a computer screen. Using the computer as a "page turner" is not exploiting it to good effect. Nonetheless, there is no doubt that computers, and hypermedia in particular, offer some real advantages over books. "Hypermedia improves on books and other media not only by providing better search and navigation capabilities, but also by being user modifiable, easily updated, and, most important, easily duplicated and distributed" (Alessi & Trollip 140). And consider: books have been around a long time, they are not going to change much—which is one of their virtues—whereas hypermedia are still in their infancy and have a dynamic future to look forward to.

When we speak of hypermedia, we think of multiple media, of course. That is, a combination of text, pictures, video and sound. For some designers (Park 1992), however, to earn the name of hypermedia, their content must also be user modifiable, and for good reason: "Permitting appropriate types of modification is a way to provide meaningful interactivity, to engage the learner, to enhance learning strategies, and to encourage the learner to encode knowledge mentally" (Alessi & Trollip 153).
Although open-ended hypermedia systems are more successful with certain types of learners (see Chen & Rada; Dillon & Gabbard), the overall advantages to the user of hypermedia are legion and should be largely apparent.

First, regarding pictorial images, they have the advantages of being relatively permanent, attention-grabbing features that are easily processed by learners and combine well with text. Moreover, “they are good for describing complex real objects and are usually more memorable than text. They do not require reading ability and are relatively language independent” (Alessi & Trollip 151), making them ideal for children and language learners, who will not be able to handle page after page of uninterrupted text. Sometimes consistent metaphors that run through a program, even if only a visual one, can be used to good effect. Graphs and diagrams, of course, help learners visualize, organize and apply information. Hypermedia programs can also offer support for learners to create their own visual images, such as tables and charts.

Second, motion images, such as video and animation, can improve motivation and are often more memorable and more meaningful, which is to say, more unforgettable. They are also good for teaching sequences and procedures, conveying well both spatial and temporal information, and in a way a book cannot.

Third, using sound with motion images has stood the test of time—for about a hundred years now. For procedures and temporal information, as well as verbal information for poor readers, not to mention children; further, for narrative information, such as stories, aural information—voice, music, sound effects—often offer an ideal combination. Moreover, “it is better than text for conveying emotional information” (151).

Fourth, many would consider an essential feature of hypermedia to be multiple modes of navigation, which encourage multiple views of how knowledge is organized, and which give learners “a more flexible working knowledge for interpreting information, for problem solving, and for
applying the knowledge in a variety of ways" (Alessi & Trollip 163). Further, they foster in learners a sense of confidence and control—important motivational factors which can be progressively developed by hypermedia programs that offer help on demand and support, and periodically remind users to take notes, review, draw diagrams, and create mnemonics in deference to the repetition principle (coaching and cueing).

Other features of hypermedia that enhance learning include: multimedia encyclopedias, dictionaries, and atlases with full-text search features, movies, aural pronunciation of words, cut-and-paste options, 3-D effects (e.g., allowing rotation of objects), and printing; problem solving, which facilitates comprehension and fosters metacognition by compelling learners to apply relevant knowledge and skills; self-tests, which can provide useful feedback to learners as to their progress toward attaining various goals; and finally, the opportunity for learners to create their own hypermedia compositions.

With so much going for it, hypermedia already seems to be in many ways an ideal learning tool, yet it is still in its infancy. Just consider what its potential will be when it reaches puberty.

**Tools and OLEs**

The following gives the barest hint of how versatile a learning tool the computer really is: "computers may be used as tutors, which deliver instruction and guide learning; as tools, which are used by students to accomplish learning and other educational activities; or as tutees, in which the computer is the learner and students are the teachers" (Alessi & Trollip 302). Examples include construction programs that allow users to actually create tabletop communities out of cardboard (Community Construction Set), that help learners make up simple stories (Storybook Weaver Deluxe), and that aid in creating newspapers, graphs, crossword puzzles, and historical timelines, to name a few. Herein we can include OLEs as well. Open-ended Learning Environments are collections of learning tools and
other instructional materials that facilitate the pursuit of multifarious educational activities.

For language learning, a fictitious town called Pueblo Lindo was created as a website divided into such different locales (chatrooms) as restaurant, school, tourist office, etc. “Users access the virtual town via the Web, navigate among the locales, and when they encounter other users, engage in conversation (by typing) in Spanish. Users are encouraged to play roles according to the places they visit, such as being a customer or a waiter in the restaurant” (Alessi & Trollip 327). The publisher even arranges for native speakers to “visit” the town periodically and assume a role, so that learners will have access to those with cultural and lingual expertise. Pueblo Lindo, as the title suggests was constructed for students of Spanish, but the idea can be generalized and adapted to teach Japanese, Chinese, English, or any other language.

OLEs encourage problem-solving, experimenting, interpreting, analyzing, taking multiple perspectives, trial and error, testing and revising. Usually this means collaborating with other learners to search, collect, organize and communicate ideas. Because such programs require great familiarity with content, they stimulate learning. Moreover, “the requirement to incorporate what has been learned into a structured environment, such as a multimedia program, forces the learner to think carefully about all aspects of the content and the relationships between them” (Alessi & Trollip 319).

Other OLE programs, such as EPSSs (electronic performance support systems) with just-in-time (on the spot) learning, along with spaced (little-by-little) practice; microworlds, allowing students to solve problems through the construction of simple computer programs; and mind tools (e.g., databases, semantic network tools, simulations, expert systems, microworlds, etc.) invite learners to explore in ways impossible without a computer or even traditional courseware, such as tutorials and drills. Mindtools may be defined as “any software that enhances critical thinking,
amplifies cognitive functioning, assists in reorganization of knowledge, is generalizable for use in a variety of situations, and is learner controlled” (Alessi & Trollip 308).

Having learners develop multimedia programs is certainly a rewarding approach to learning. An added bonus is that many such projects encourage or demand collaboration or cooperation. Programs that compel them to analyze, question, challenge, debate and offer suggestions about each other’s work merit all the more commendation. Earth Trails, for example, is a program that takes users on an outing to western Iowa’s Loess hills to explore their geology, plant and animal life, and to solve various learning tasks.

The goals of the Earth Trails project is to use interesting places as the basis for virtual environments that are fun and interesting to explore and learn about, that support a variety of school subjects and types of learning, and that can be used in many ways according to learner or teacher interests. These environments foster networking and collaboration among learners, teachers, and professionals. (Alessi & Trollip 324)

By now it should be clear that OLEs and other computer tools are unique learning devices that can motivate learners as well as instructors, deepen learning and transfer, be applied across divergent curriculum areas, and support constructivist learning environments and collaborative learning. They help foster careful thinking and planning and force learners to distinguish between relevant and irrelevant information. As Alessi and Trollip attest,

For us, an OLE program is one that permits learning in natural and flexible ways. Learners and instructors can bend or modify them to accomplish a variety of goals and generally use them in conjunction with other on-line and off-line learning materials. They usually emphasize
cross-curriculum or multicultural learning and almost always incorporate group or collective learning. Increasingly, we expect to see OLEs that incorporate multiple methodologies (games, simulations, drills) and combine the use of materials on CD-ROMs, in books, and on the World Wide Web. (327-28)

Educational games

The most attractive aspect of games as learning tools is their ability to motivate learners to play them. Games are seen as fun; in fact, it is axiomatic that games are meant to be enjoyed. If they are not, we would say either they were not games at all or they were unsuccessful and unsatisfactory ones, however adequate they were as learning tools. Nonetheless, if they were merely enjoyable and taught nothing of value, they would not be educational, which brings our thesis to its main point: progress toward successful completion of the game, or winning, must be inseparable from the learning process, and the game scenario directly related to what is to be learned. Thus, Alessi and Trollop:

In an educational game the game’s goals must reinforce the learning objectives. That is, to facilitate learning[,] a game should ensure that successfully achieving the game’s goals (winning) comes about by the application of the skills or knowledge to be learned rather than by luck, tricks, or unintended skills. Furthermore, intermediate progress toward the game’s goals should be contingent on progress toward the learning objectives. Learning is enhanced most if progress is an immediate reward for learning and if it is perceived as such by learners. (280)

The rules and goals of games should be clearly stated and subject to participant review. If greater entertainment value increases learner motivation, however, what increases entertainment value? The short answer is more “bells and whistles”. In other words, the visibility, video, three-
dimensional animation and sound effects that only multimedia can provide and that make the computer such a versatile learning tool. These are extrinsic motivators, to be sure, but just as it helps to have an attractive appearance to get someone interested enough in you to want to get to know your intrinsic worth, so too with games: as “door-openers”, extrinsic motivators should not be devalued.

But the longer answer is: for a game to be entertaining it must be challenging. That is, its scenario should be novel and surprising without being incomprehensible; its environments, neither too simple nor too complicated to negotiate; its goals, neither too easy nor too difficult to attain. Following Malone, we list four principles of uncertainty that will tend to render games more challenging and, therefore, more interesting:

a. variable levels of difficulty
b. multiple-level goals
c. hidden information
d. randomness

The first principle merely means that some situations will be easily mastered while others will not. This provides a balance of immediate reward and ongoing challenge. The second principle recommends that the game have adjustable levels of difficulty; to wit: as a player advances in skill and knowledge, the game becomes more difficult and harder to win. With some games, however, there really is no winning—only losing (Tetris comes to mind). In other words, they are continuous, increasing in difficulty until the player will almost certainly be knocked out of the competition. With educational games, however, the crux is: however far (or unreachable) the goal, the player must continue to—and continue to want to—learn the extra-ludic knowledge the game was designed to teach.

As for the third principle, the idea here is simply to heighten the uncertainty, for “the attraction of a game is increased if each player is
uncertain about some facts needed to attain the goal” (Alessi & Trollip 287). In Monopoly it’s the roll (and role) of the dice; in Scrabble, the letters one draws from the pool after each turn, the double-and triple-word-value spaces available on the board, and the layout of the words already on the board; in poker, the hand one draws and the bets, calls and bluffs of one’s opponents. Such unknowns, of course, increase curiosity, thereby enhancing motivation.

Finally, randomness speaks to the role that chance or random fluctuations play in the game—in other words, luck, who is a fickle lady that cannot be cajoled or coerced. Again, however, a healthy balance between the results of chance and skill must be preserved lest the knowledge the game was meant to teach proves unhelpful in advancing the player toward victory, thereby severing the close relationship between the game’s goals and the reinforcement of learning objectives. In other words, the successful pursuit of it should not stem from luck so much as from learning that should be rewarded by advancement toward the goal. It is good to keep in mind that learning may be either intended or incidental, both being very useful. One example is the beginning tennis player who is taught the basic strokes and then pitted by her coach against an opponent on the same level. As she plays, she learns to hit the ball better, which is the intended learning goal. But she also realizes that, when her opponent is facing the sun, he will have a more difficult time returning the ball well, or even at all, when she hits lobs (high returns) which force him to look up towards the sun. This strategy and her improvement in hitting lobs can be called incidental knowledge.

It should be borne in mind that games are not the most efficient learning tools. For a given amount of time, the student will learn more, say, vocabulary words from a drill than a game because the latter requires time to read directions, learn and follow its rules, take turns, pay penalties, and become familiar with the game procedure. What is sacrificed to efficiency, however, is gained in motivation. Few do not enjoy playing good games.
Two other caveats are worthy of mention: both penalties and the fantasy world the game creates may detract from learning. When penalties are intensely avoided, players may fail to take risks, thereby inhibiting exploration and experimentation. As for fantasy, if players get too caught up in the fictional world of the game scenario, they may forget about the learning goals or no longer care about them. Again, the solution is to link fantasy to learning objectives. Lastly, when winning becomes all-important, learning becomes secondary by definition. The intense competitive drive of some players, however, can be somewhat deflated by team competition or by games in which advancing, not winning, is the only possible objective.

To conclude, “Games are powerful educational tools if used appropriately. They may have a strong motivating influence on children and in some subject areas on adults. Games can also be good for integrating learning across a number of subject areas. They can directly contribute to learning objectives related to competition, cooperation, and teamwork” (Alessi & Trollip 298).

Conclusion

In sum, computers and multimedia are great learning devices but they still have their intrinsic limitations. Again, as learning tools they should be complementary or supplementary and by no means exclusive. The problem with computers is that, despite the wealth of variety, they are still in an early stage of development. We have not yet gotten creative enough with them, nor have we yet made them human enough. Consequently, we can interact with them, and they with us, only in a handcuffed manner. Thus, they still don’t respond to us orally, see only myopically, and don’t listen very well, either. Nor do they have any personality to speak of. Nor, for that matter, can they yet diagnose their own problems, not to mention fixing them. In other words, they are still severely handicapped.
Nonetheless, this can and will be fixed. A computer is a man-made machine, after all, and man can teach it to respond more naturally and productively, and become more adaptable to human needs. At the same time, we must be aware of the dangers Stoll and others are warning us about, i.e., not to spend too much time at the keyboard to the neglect of our surroundings and those near and dear, both geographically and emotionally. In other words, we must be cognizant of and adaptable to our own human needs.
References


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