1.5.3 The Conduit vs. the Berry Bush

Scollon and Scollon (1982) distinguish between two metaphors for communication. The first is the conduit metaphor, in which information is packaged for delivery by an originating entity and passed in linear fashion, as if along a conduit, to a receptor at the other end who receives and processes the information. This, according to the Scollons, is the metaphor that manifests itself in drill and practice and which is found to be inappropriate when applied to CAI. A more appropriate metaphor, they say, is berry-picking, in which the learner treats information as if it were berries on a bush. The teacher/facilitator arrays the information on the bush, and the learner picks and chooses what strikes him, stopping when sated and returning to the bush when hungry.

Scollon and Scollon (1982) have observed differences in the way children and adults approach computers. Adults see computers as functioning linearly, according to the conduit metaphor. Thus they tend to balk at individual steps, thinking they must overcome each successive problem in order to proceed. Conversely, "the child approach is global and recycling." (p. 10) Children, whom the Scollons have observed to be more successful than adults in their approach to computers, tend to experiment until the problem is solved, treating the computer in the metaphor of the berry bush. The Scollons conclude that success with computers runs parallel to freedom from approaching them with "relentless, linear logic." (p. 10)

The conduit metaphor, the "predominating metaphor" in drill and practice, forces computer users into the straight jacket of "relentless, linear logic". This, to the Scollons, is an abuse of the elusive "nature" of computing. "The role of the 'writer' of the software [is not] of someone communicating to someone else. . . . The role of the user is by the same token, not a role of receiving any message but rather one of exercising the options available for the creation of a discourse in the micro-world presented by the designers." (p. 7) Steffin (1982b:24) likewise notes that when CAI makes inroads into education, the teacher's role will change "from that of a broadcaster of instruction to a manager of instruction."

1.5.4 Microworlds

In the Scollons' micro-world, creativity is not held by the writer, as it is in the conduit-world, but is shared with users, and this is "attractive" to children and "threatening" to adults. (This might account for the fear that Peelle [1982] mentions learners have at their first encounter with computers.) Papert (1980a) sees similar threats to users in most existing implementations of computers; thus his work has been devoted to the creation of "microworlds" as "incubators of knowledge" (p. 120). Learning takes place within such worlds as learners exercise their freedom to explore the microworld. In school, according to Ulric Neisser, "we leave life at the door, as it were, and solve problems that other people have set. The problems are assigned to us arbitrarily, out of context. They emphasize words and symbols rather than objects and actions." (quoted in Goleman, 1983:57) In microworlds, "learning is not separate from reality" as it often is in schools. (Papert, 1980a:179)

In microworlds, learning occurs much as in "earlier societies where the child becomes a hunter by real participation and by playful imitation." (1980a:179) In the context of ESL, where real participation can be found in interactions with teachers and/or with an English speaking environment, the computer can play a critical role in providing contexts for "playful imitation". Higgins (1983) has carried just this idea into microworlds of ESL with his concept of "Grammarland", in which students solve mysteries by asking questions of the computer and inducing solutions from the computer's responses. Higgins's Grammarland, like Papert's Mathland, is a microworld to which students can retreat when they want to learn English by doing something besides "learning English".

1.5.5 Games and Autotelic Environments

Probably all societies institutionalize similar modes of playful imitation in the form of games. Games are seen in these societies as integral vehicles of socialization, i.e. learning. Moore and Anderson (1969:50-1) characterize such games as "folk models", meaning that they are devoid of serious consequences, that they are autotelic (that is, "they contain their own goals and sources of motivation"), and that they nevertheless are taken to be serious activities. Autotelic environments then encompass activities which are done for their own sake, and such environments are in turn components of folk models and of the "clarifying educational environments" discussed earlier.

In a game, or in an autotelic environment, the participants create a kind of "microworld" in which they have freedom to explore the consequences of their "moves", subject to certain constraints and parameters. No one who has visited a video arcade can doubt that computers lend themselves remarkably well to this kind of activity; the question is rather whether the attraction and holding power of computer-based games can be applied in creating autotelic environments in education.

Games, says Stone (1980:47), give students "an immediate sense of the computer's approachability." Rowe (1983) paints a scenario illustrating the computer's holding power. Implicitly behind Rowe's characterization of how one might learn French incidentally while striving to excel in flight combat is Stevick's (1982:131-2) idea that "the quality of the learning that takes place when we focus our attention only on the items to be learned is different from (and probably inferior to) the quality of learning that is incidental to something else that we are trying to do. That principle applies to all language games . . . "

Stowbridge and Kugel (1983:183) used games to teach students who had previously had aversions to learning (i.e. to certain educational paradigms). They echo Stevick's remarks in the four fundamental principles of their research. These principles are (1) that students "learn by thinking about what they are doing when they try to learn", (2) that this is accomplished by doing rather than by discussing theory, (3) that games provide an appropriate mode for this kind of discovery, and (4) that what is gained in this process is transferable to other subjects when attention is paid to the transfer process.

Stevick stipulates that games begin from something that all players have in common, that all games have set rules, that players have control over options within the framework of the game, and that all games have goals. Stowbridge and Kugel point out that the computer is an excellent medium for games because it is strict yet non-threatening in applying rules, because the player is the only person with control over the game, and because the computer can play tirelessly and on demand. The authors also point out that students are relaxed when playing games and readily assign them value, whereas they may not so readily assign value to abstract concepts taught in a classroom.

Computers can be made to appear as unfathomable puzzles. Humans are generally drawn to puzzles; thus they are drawn to computers, but like any puzzle, humans are only interested as long as the puzzle is unfathomable. Once the facade of complexity has been stripped away and the cheap trick that makes the program work has been exposed, the value of the computer in education diminishes to that of any other teaching device. Hence, another way of interpreting success in educational computing lies in understanding what draws students to computers (and puzzles) in the first place, and then what keeps them there.

1.6 The Problem of Software

Full scale development and implementation of CAI has to date been largely neglected by the educational community. There are many reasons for this, most of which lie outside the scope of this thesis. However, it is widely acknowledged that the greatest hindrance to the rapid implementation of CAI at present is the dearth of courseware of adequate quality. Braun (1980) cites lack of courseware as one of three reasons for the role of computers in education being minimal at present. Frenzel (1980:86) says the fact that "CAI has never been extensively used nor has it lived up to its expectations" is due primarily to lack of courseware (and see also Jorstad, 1980; English, 1983). Miller (1980) finds educators irresponsible in their neglect of courseware development for CAI.

If CAI is indeed desirable, then why is there such a dearth of adequate courseware? For one thing, there are administrative hurdles to the development of CAI. For example, administrators don't in general provide training for instructional staff who desire to be courseware authors (Jorstad, 1980, Otto, 1980; Braun, 1980), nor do they in general provide release time for instructional staff to develop their skills in CAI (Jorstad, 1980; DeLorenzo, 1979). This is chiefly because administrators are not confident that their instructional staff can develop the necessary courseware without help from professional programmers, and they don't wish to add the latter to their payrolls.

Furthermore, there is lack of academic recognition for work with CAI per se (Dodge, 1980; Marty, 1981). Marty notes that this lack of recognition results in development of courseware falling by default to programmers with no teacher training, and that the poor pedagogic value of the resulting courseware leads in turn to further erosion of confidence in CAI. Smeltzer (1981) predicts that commercial software will be used initially by teachers and that this will be found "not necessarily designed to meet the unique instructional needs of [the] classroom. Increasingly, teachers will demand individually designed computer programs." Computer specialists will be called upon to provide these programs, at which point "the question is whether or not these programs will be educationally sound." As Bork points out (1981:9), "It is only through the development of sophisticated learning material, coming from excellent teachers with great understanding of the learning process, that we can hope to achieve the full potentials of the personal computer as a learning device. Little such material is currently available." Thé (1982:52) attributes "the most fundamental problem" with CAI to the fact "that most educational software is written by programmers who know nothing about pedagogy."

It is obvious that instructors must have a hand in the courseware development process. DeLorenzo (1979) recommends that the coordinator for CAI be appointed from instructional staff rather than from a pool of programmers. But how much of a hand must programmers take in development of pedagogically sound CAI? Merrill (1982), in counselling against recourse to authoring languages (such as Apple PILOT), suggests that the best software results when subject matter experts team up with programmers who can work in sophisticated programming languages. English (1983) thinks that the formation of teams composed of people with expertise in programming, education, and design would put educational software development on the right track. Bork suggests that artists be included on the team as well. In reports of CAI implementations (e.g. Fox and Rushby, 1979), interface between programmer and subject-matter specialist is almost taken for granted.

In spite of the existence of authoring systems which enable subject-matter specialists to design and implement their own CAI systems, little mention is found in the literature regarding projects in which course instructors have implemented CAI without the aid of programmers. Frenzel (1980:90) says that "it is relatively easy to take subject matter experts and teach them concepts of programmed languages. But this has not been done." Stevens (1980), on the other hand, reports having trained half a dozen computer-naive ESL instructors to, in the course of 8 weeks, write, enter, and test two dozen CALL lessons. Therefore, it appears that CAI implementation by subject-matter instructors, despite intimations to the contrary, is indeed practicable.

1.7 The Experimental Question

In light of the foregoing, it seemed appropriate and desirable to conduct an experiment in the field of CAI which would (a) require development of pedagogically inspired courseware, a contribution in itself, and (b) test some variable within the medium of CAI rather than test CAI against other media. In preparing for and conducting this experiment, it would be shown that a language instructor could learn from scratch a courseware authoring language (Apple PILOT) and write viable CAI in that language. In addition, this research would address one of the relatively untested domains of CAI implementation: the context of stand-alone units, teaching something apart from the students' regular coursework. Furthermore, something would be learned about some of the many untested variables within CAI.

The variables chosen for this project were those of choice and control. Choice and control were manifested in the experiment by students having, in one lesson, the ability to choose sentences they wanted to concentrate on and also the ability to control what part of the CAI lesson they wanted to be in. Since the students made these choices using game paddles attached to the computer, the choice and control lesson was designated PDL (for paddle). Another lesson, designated REG (or regular), did not allow mobility with the lesson to come under control of the students.

Four hypotheses were tested in the experimental portion of the thesis. These were:

H1: that both CAI lessons would be effective in teaching in each experimental situation,

H2: that the PDL lesson would teach more effectively than the REG lesson,

H3: that use of CAI would result in favorable attitudes from the students, and

H4: that students working the PDL lesson would have more favorable attitudes than students working the REG lesson.

The following chapters discuss how the theory in this chapter was applied to the creation of pedagogically sound ESL courseware, and how that courseware was tested against the above four hypotheses.