Social Aspects of Human-Computer Interaction

William Lynch

Research and policy responses to the growing reality of educational computing have paid little attention to the social role of computers in the curricular world-as-lived. When the computer is seen strictly as a technical medium for the communication of ideas, its symbolic quality as a cultural form goes unexamined and unrecognized. This article discusses the social role that computers play in the culture of the classroom and exhorts technologists, curriculum planners, and policy-makers to consider the possible role that computers can have on social as well as intellectual development.

Background

In the typical approach to characterizing the machine's role in the classroom the computer is cast as neutral, as a tool to enhance, train, or explore the user's ability to think (Taylor, 1980). Numerous authors have argued that communications technologies as cultural products are not neutral. Cultural products change human beings even as they are being made and used by them (McLuhan, 1964; Williams, 1974; Weizenbaum, 1976). Humans are not simply reactive to their environment, they are interactive, constantly altering symbolic reality through interaction with the newly created world. How does this happen?

- Is there an identifiable set of relationships between humans and computers?
- Is the computer a social entity which participates in the construction of reality through its interaction with human users?
- Does interaction with a computer alter the user's perspective on the world or about themselves?

There can be little doubt that there is a social relationship between humans and many of their tools. People define themselves in terms of their primary tools and often develop intensely personal relationships with them. Consider how adolescents feel about their automobiles, or musicians about their instruments; we assign names to objects, yell at and cajole them, sleep with them, and often allow them to supplant more difficult relationships with other humans. The 'intelligent' roles filled by computers as experts, teachers, knowledge engineers, and problem solvers is prima facie evidence that these machines are more than just tools. If we admit that humans and computers do have social relationships, we must recognize that there is a community of computers and humans which can be constituted and studied as a social group (Fields, 1987; Woolgar, 1985; Bolter, 1984).

Even if computers can be considered as social players, can they be subjected to the kind of analysis typically used to characterize humans? Certainly gender differences should be examined, as should class origins and orientation, racial and ethnic membership, economic status, cultural experiences, personality traits, world view and, of course, access to power and authority. Do computers have these characteristics?

The computer is a reflective medium, in some ways similar to other reflective media like films, television, radio, recordings, paintings, even books. Reflective in this case means that the medium carries forth certain personal characteristics of the authors, directors, performers, and editors responsible for production. Computer hardware and software production is the result of enormous effort on the part of engineers, authors, programmers, and even marketing people. A particular computer, its basic operating system, and any software which will work on that computer reflect an individual's or group's personality, values, beliefs, and life experiences in some combination. Thus, when a user interacts with a computer he/she is interacting with the physical device, to be sure, but more so with the designers of the apparent intelligent behavior that a machine displays. The designers all have racial, gender, class, economic, and philosophical characteristics which are predictably reflected in the work they do and the products they create.

If other communication mediums are reflective, what then is unique about the computer such that it elicits powerful responses from its users? Books certainly evoke emotions, elicit responses, and carry forth the personality and experiences of the author, as do television and radio productions. Computers, however, represent the only reflective medium which is also *interactive*. Interactive can best be understood as the potential for the user of the computer to participate or influence the computer's response(s). Books, films, recordings, and television are one-way communication devices.

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While each can elicit a response from the user, none can respond specifically to that user; whereas a computer with appropriate software can respond in innumerable ways to the varying responses of the user. Only living things have similar capabilities and it is precisely this characteristic, this similarity to 'aliveness', which allows a relationship to be established between human and machine.

It is critical to recognize the personal implications of reflectivity and interactivity in educational settings. As a reflective device, the computer serves as a projector of the self; but the image that is reflected to the user is interactively produced, involving the minds that created the projector as well as the user's. Thus, the image of the mind that is experienced is one of the mind in a relationship with other minds; a social image. This is precisely the image of the self that is available to individuals in other social situations; it is a mediated image. The concept of the mediated image suggests that if the changing social role of the user is to be understood, the social role of the computer must also be understood. How then can the computer be understood from a social perspective?

The interaction of human beings occurs at a point of contact, whether it be visual, auditory, or physical. The interaction can be immediate and direct, as in shaking hands; immediate and mediated, as in a telephone conversation; or deferred and mediated, as in a letter. These points of contact reflect the human-to-human interface. The interaction of humans with machines takes place under similar conditions. In both cases, interaction is most effective when procedures for interaction are known and anticipated.

There is, however, another level of interaction which is part of the human-computer interface. Human-computer interaction not only involves the physical point of contact; it also includes temporal, spatial, cultural, and experiential contexts. The human-computer interface is different if one computer is shared by thirty students compared to one computer for each of thirty students. Computers may also only be available at specific times and for specific purposes. Furthermore, the beliefs held about computers, ideas about the roles they should and should not play, and the perceived threat or benefit which is offered are also part of the interface. In other words, in addition to the obvious differences in the interface at the physical level, there is a unique dimension to the interface that occurs because individuals encounter it with different backgrounds, attitudes, and beliefs.

A standard interface, no matter how well-conceived, is not likely to meet the needs of all users. To some extent options can be provided to attend to the social and psychological needs of users, but if not all those needs can be addressed it is important to recognize that specific values, beliefs, and assumptions are thoroughly embedded in the interface itself. Users will be asked to adapt to the interface and, implicitly at least, they will be asked to embrace those assumptions. The normative dimensions of the interface should not be allowed to exist *sub Rosa*, they should be revealed and a rationale offered. If the normative dimensions of the interface cannot be avoided, they can be identified and be made explicit to students as choices. Even with these efforts at accommodation, those individuals who do not wish to adjust, or who cannot adjust to a particular interface will likely be perceived as failures with a technology, when the reality will be that what failed was the technology's interface.

It should appear reasonably clear that if the social role of the computer in classrooms is to be understood, research will have to begin with the human-computer interface in its ideosyncratic formulations. Researchers concerned with the human-computer interface generally assume that the true terminal (end-point) of a computing system is the human user. They argue that the true terminal is already designed and that technology designers can only design according to its characteristics (Bolt, 1984). From this extremely rational approach to design comes the state-of-the-art in human-computer interface, the user-friendly computer. Human factors research is scientifically premised and statistically founded, but to assume a universally friendly interface is to assume a degree of uniformity among humans that is unrealistic. Shneiderman (1987) points to confusion arising from cultural differences when icons meaningful to the software designer are alien to some communities. The result of the assumption of graphic universality is a lack of recognition that one user's computer friend is another's enemy. An extremely facile operating environment for one user may be the zenith of frustration for others.

The variability of educational populations (especially those in schools), according to cognitive style and ability, learning style, cultural origin, life experiences, age, gender and race raise a number of interesting questions concerning educational experiences in the context of the human-computer interface. Is the interface left-brain or right-brain oriented? Does it assume a certain level of cognitive ability or prior orientation? Is one learning style favored over another? Is there a cultural bias built into the interface? Is there a class or occupational bias to the interface? Does the age of the user affect success with basic operations? Does the gender of the user influence successful use? Research is needed to determine how software biases are managed by real users in educational situations.

When researchers are concerned with making conclusions about the human-computer interface, how much experience a person has had with computers or a particular system must always be considered. Experience has to be established not only in quantitative terms, such as how many weeks, months or years, but also in the quality of the experience. Often bad experiences with computers lead to significant assumptions about computer use which is difficult to undo and inhibits successful use even with very friendly interfaces. The experience variable alone ought to suggest clearly the diversity with which users encounter a computer interface. A variety of questions can be asked about the human-computer interface in education in order to understand the social dimension of a computer, but how can this be done within the context of a lived curriculum?

While both experimental and holistic approaches are necessary for research on computers in education, the analytic, experimental approach needs to follow more open-ended inquiry "when modes of computer usage are still in the making" (Salomon and Gardner, 1986). Extending this line of reasoning, one failure of past research efforts with technology has been in asking, "Who learns how much of X?" rather than "Who learns what?" By posing the question in this way the research orientation becomes more interested in curricular outcomes than in instructional effectiveness. Once the universe of what is being learned can be established, experimental style research becomes feasible. When the purpose of the research is to understand the relationship between two socially characterized groups, a methodology is required which can reveal the implicit, hidden, and subtle meanings inherent in the interaction between these groups.

Computers in Classrooms: An Empirical Study

Based on the above theoretical framework an empirical study of human-computer interaction was undertaken during the first four weeks of two semesters. Two classes in a predominantly black urban high school were observed during the first semester, and three undergraduate classes at a predominantly white university were observed during the second. The five groups were chosen because of their diversity in order to establish an overall sense of interactivity patterns among people with significantly different social characteristics.

The decision to look at students' initial experiences with computers was made to examine how relationships might evolve through various stages without the encumbrances of previous problems.

In addition to systematic observation of the classes, formal interviews were conducted and informal questioning of the students occurred during class time. Field notes and students' responses were analyzed for evidence with which to understand the nature of the human-computer interaction in each setting. Obviously, more subject groups would enhance the tentative findings presented here, but the time intensive methods utilized for data collection and analysis make the going slow, but hopefully, sure.

Interaction Characterizations

The high school classes included a BASIC programming class and a computer applications class. In the BASIC course the students were self-described as middle class. No students' families received public assistance. The BASIC students were college bound and were eager to gain skill in this advanced course. Students in this class used a BASIC interpreter in an MS-DOS environment. About ten percent of the students owned computers and had used them, but the balance had no previous experience except with the direct manipulation style of video games. There was no obvious fear or awe of the computer in this group and students readily took their turn at the machine. Part of the computer interface in this class was the human-to-computer ratio of one computer for every two students. Students were not permitted to work in pairs and did seatwork until it was their turn on-line.

The screen interface was that of a command line BASIC interpreter. Students in the BASIC class were not good typists, which slowed their data entry considerably, and a fair amount of interaction attention was therefore focused on the keyboard. The teacher of the class distributed model programs and exercises, which the students attempted to enter correctly; original programming was written out as part of the seatwork assignment and was entered on-line. This approach was considered good programming form by the teacher; the result, however, was very little thinking or problem solving on-line. Students tended to spend the entire on-line session concentrating on data entry, which resulted in very little response from the computer and, therefore, little reaction or action on the part of the student.

Students in the BASIC class did not view the computer as personable, and their interaction style was typically that of a human with an appliance. Because of the instructional approach used, interactivity with the computer was kept to a minimum during the time of the observations. Students focused much more on procedural skills involved in learning BASIC than on interaction with the machine. Interviews revealed that students viewed the computer instrumentally; that is, as a means to an end. There was no apparent difference in style between boys and girls, except that girls tended to be more accurate at keyboarding. The class was almost evenly divided between boys and girls.

Students in the computer applications class were more diverse in their backgrounds and future plans. About thirty percent of this group planned on college and were taking the course to help them in college. Seventy percent were more immediately career oriented and were enrolled as a means to improving their personal marketability for some kind of clerical position. Students described themselves as middle class or lower middle class; fifty percent of the families represented received some kind of public assistance. No students in this class owned a computer, but again most had experience with some kind of video game.

Every student in this class worked at a Apple II microcomputer workstation, and there was virtually no seatwork. The substance of the class consisted of learning to operate the equipment and the AppleWorks application software. AppleWorks is an integrated software package which includes a word-processor, data-base, and spreadsheet. The software is designed so that information from one tool can be moved to other tools to facilitate report production, and multiple documents can be opened at once. Instruction in this class consisted of an explanation of the software tools and practice using the software. Students were given assignments to complete and protocol sheets describing the necessary keystrokes to complete a particular operation.

AppleWorks uses cursor and function keys to enable direct manipulation of menu options and editing tasks. In addition, a screen metaphor of file folders is used to indicate the nested relationship of AppleWorks functions and files. This characteristic of the software interface is designed to give users a sense of context within the electronic world of the computer. The teacher in this class introduced the folder metaphor early in the class, but never returned to it, preferring to rely on a procedural protocol approach to operations. Predictably, most students relied exclusively on the protocols and never developed a sense of how to use the metaphor to help them navigate through the software.

When asked about the desktop metaphor, students responded to the effect that they did not understand why the "lines" file metaphor were there or that they were a frame around the screen. When asked how they knew what to do when confronted with an assignment, the typical response referred to the instruction sheet, which outlined the steps procedurally. Students in this class referred to the computer as a more dynamic entity in the classroom than did the BASIC group. Responses centered around what the computer "did" and how it "did it." The computer was referred to as capable of action and response, but only the pronoun "it" was used. While the machine seemed to participate more in the classroom action, students in this class clearly viewed the computer as the subject of instruction. The user interface did not appeal to any students in this group at the personal level.

The third group studied was a collection of three computer literacy classes at a private university. The classes were composed primarily of white middle to upper middle class students ranging in ages from nineteen to twenty-one. Ten percent of the students in the classes were born in so-called third-world countries and had completed their precollegiate education in their home country. Only the foreign born students were receiving financial aid of any kind. Most of the students were planning a career in teaching; other majors represented included business administration, marketing, tourism, and psychology.

Several software packages were demonstrated during this class, but of particular interest was Microsoft Works, an integrated software package much like AppleWorks except that a graphing tool and communications package are included. In addition, students had the opportunity to use versions of this software on both the IBM/PS2 and Macintosh systems. Instead of protocols, however, the instructor encouraged the students to experiment and explore capabilities of the software, after offering an overview and demonstration of the software design.

Students in this class readily adapted to the combination keystrokes necessary to manipulation of the pull-down menus and select options on the IBM system and, although miscues were frequent at first, they were largely eliminated by the end of the fourth week of study. When asked, all but two of foreign born students were able to explain the organizational scheme of the interface and offer both complimentary as well as critical comments on its usefulness.

Initially, three students in the classes requested the equivalent of the protocol approach observed in the AppleWorks class; the instructor refused to supply these and instead encouraged the students to practice certain skills with the aid of their textbook. By the end of the fourth week these students were slower than the rest of the class, but seemed to have improved. Students in this class audibly responded to the computer on occasion, but usually in terms of frustration. Positive relations with the computer were expressed out loud when a surprise was involved, such as finding a hidden feature.

Conclusions

- **Was there an identifiable set of relationships between humans and computers?** Relationships with the computers existed in all circumstances; however, what was observed in the BASIC and Applications classes was not a personal relationship, but clearly that of a person to a machine. In the Computer Literacy classes, students were much more oriented to working with the hardware. Although they did not refer to the computer as a person, they did admit to thinking of it in a human role, often as an assistant. Most of the computer literacy students also acknowledged that they thought of the machine having an existence of its own. None of the groups acknowledged any recognition of values or biases embedded in the computer interface, but all felt that the designers and programmers were probably white, middle-class, and in their thirties. The obvious values in the human-computer interface were in the context of the students' expectations and the teacher's instructional approach, each of which resulted in a far different experience and different type of relationship for the different groups of students.

- **Did interaction with the computer constantly alter the user's perspective?** In the BASIC and Computer Applications classes examined, the computer did not appear to alter the user's perspective about much. Some evidence suggested that students could see their content work (e.g., BASIC or writing) differently through the lens of the computer. Perhaps most significant, however, was the development of a symbolic quality attached to the use of the computer. As members of all the groups acquired skill with operating the machine, they exhibited a self-esteem correlated with this accomplishment. The computer was figuratively worn like a badge of achievement. The fact that they could master the operation of the computer symbolically indicated a personal quality which they found satisfying and changed their place in the world.

- **Was the computer a social entity which participated in the construction of reality through its interaction with human users?** The question suggests that an influential relationship existed between the computer and the human user, but none was observed or detected. Students did not appear to develop a clearer or different sense of themselves because of their interaction with the computer.

Summary and Discussion

The conclusions that emerged from the collected data seemed to support the contention that relationships with computers do occur; but it also suggests that these relationships do not have to be personal and, in fact, initially are not. In addition, teaching style and curricular objectives appear to have an obvious influence on the nature of the relationship that is possible for students to develop. When the computer is positioned and clearly treated as a tool, it will in all likelihood be perceived as one by the students. Contributing to the tool image is the stripped down non-anthropomorphic screen interface which characterizes some software and hardware platforms. The Macintosh data seem to indicate that the more inviting the perceptual and physical interface, the more likely students are to see the computer as possessing a personality of a sort.

Unfortunately, the variation in teaching approaches and in perceptual and physical interface designs, and the differences in basic social characteristics of the study groups cast a shadow over the above conclusions. It is clear that any one or a combination of these characteristics could have led to the between-group differences recognized. Furthermore, new users may not be the best group to study when looking for a recognition of relationships. It is possible that human-computer relationships take time to grow and mature. Experienced users may provide better information on this idea. It is also possible that the 16-22 age group studied is not particularly open to developing the kind of relationships discussed.

The issues involved in the social dimension of human-computer interaction are many and may be difficult to identify in all of their complexity, but this should not discourage technology professionals from being concerned with their importance. In the least, thoughtfulness and careful decision-making regarding the social aspects of software and hardware interfaces is necessary to the conscious design of computing experiences. □

References

Bolt, R. *The Human Interface: Where People and Computers Meet.* Los Angeles: Lifelong Learning Publications, 1984.

Bolter, J. D. *Turing's Man: Western Culture in the Computer Age.* Chapel Hill: University of North Carolina Press, 1984.

Fields, C. Human-Computer Interaction: A Critical Synthesis. *Social Epistemology,* 1987, 1, 5-25.

McLuhan, M. *Understanding Media: The Extension of Man.* New York: Signet Books, 1964.

Olds, H. The Microcomputer: An Environment That Teaches: Exploring the Hidden Curriculum. In *The Computer: Extension of the Human Mind.* Eugene, OR: University of Oregon Press, 1982.

Salomon, G., and Gardner, H. The Computer as Educator: Lessons From Television Research. *Educational Researcher,* January 1986, 13-19.

Shneiderman, B. *Designing the User Interface: Strategies for Effective Human-Computer Interaction.* Reading, MA: Addison-Wesley, 1987.

Taylor, R., *The Computer in the School: Tutor, Tool, Tutee.* New York: Teachers College Press, 1980.

Weizenbaum, J. *Computer Power and Human Reason.* San Francisco: W. H. Freeman, 1976.

Williams, R. *Television, Technology, and Cultural Form.* London: Schocken Books, 1974.

Woolgar, S. Why not a Sociology of Machines? *Sociology,* 1985, 19, 557-572.

Events Calendar

- **CAUSE Summer Institute.** The CAUSE Summer Institute on the Management of Information Technology in Higher Education will hold a professional development program for new and prospective managers in Boulder, Colorado on June 24-27, 1990. The program will focus on management skills, service skills, and newly emerging technologies. Contact: Julia Rudy, CAUSE, 4840 Pearl East Circle, Suite 302E, Boulder, Colorado 80301; (303) 449-4430.

- **Information Systems Conference.** The Annual Syntopicon Conference of the Association of Information Systems Professionals will be held June 24-28, 1990 in Phoenix, Arizona. Among the tracks to be covered are Education, Training, and the End-User and Hands-on Software Training. Contact: Carol A. Green, AISP, 104 Wilmot Road, Suite 201, Deerfield, Illinois 60015; (312) 940-8800.

- **National Training Conference for Leadership and Instruction.** The Illinois Renewal Institute will hold its 6th Annual National Training Institute Conference on July 7-15, 1990 in Lake Tahoe, California, and on July 21-25, 1990 in Williamsburg, Virginia. The conference will feature programs on "Cooperative Learning," "Critical and Creative Thinking," "Whole Language," and "Teaching for Transfer." The programs will be led by Roger and David Johnson, Robin Fogarty, and David Lazear. Contact: Gail Moss, Coordinator Communications and Marketing, (800) 922-4474; in Illinois (708) 991-6300.

- **Action Research Meeting.** The first combined Action Research and Process Management World Congress will be held July 10-13, 1990 at Griffith University, Queensland, Australia. The focus will be on industry, government, and higher education projects. Contact: Ortrun Zuber-Skerritt, Congress Convenor, Griffith University, Nathan, Brisbane, Queensland, Australia, 4111; (07) 275-7111.

- **Adult Literacy and Technology Conference.** The Fourth Annual Adult Literacy and Technology International Conference will be held July 18-21, 1990 in St. Paul Minnesota. The conference will discuss how technology can be employed to meet the literacy needs of adult learners. More than one thousand attendees are expected. Contact: Cheryl Zaccardi, Conference Planner, 740 York Avenue, St. Paul, Minnesota 55106; (612) 290-8330.

- **Interactive Technology Seminar.** The University of Georgia will host the AECT/UGA Professional Development Seminar 1990. The seminar titled "New Directions in Developing Interactive Instruction" will be held in cooperation with the Association for Educational Communications and Technology and will meet on July 21-25, 1990 at the Georgia Center for Continuing Education on the UGA campus. On Monday, July 23rd, a state-of-the-art two-way teleconference will be shared between the seminar's Athens, Georgia site and a second Detroit, Michigan site. Schools or agencies interested in downlinking the sessions should contact: Dr. C. Hugh Gardner, Instructional Technology, University of Georgia; (404) 542-3810.

- **Software Design Workshop.** "Software Design for Higher Education" is the title of a workshop to be offered July 23-27, 1990 by the National Center for Research to Improve Postsecondary Teaching and Learning (NCRIPTAL) at the University of Michigan, Ann Arbor. The five-day workshop is designed for faculty members and others involved in the development of instructional software programs for college and university students. Attendance is limited to 25 persons. Contact: Etta Vinik, Coordinator, 2400 School of Education, the University of Michigan, Ann Arbor, Michigan 48109; (313) 936-2743.

- **Summer Instructional Technology Institute.** The Second Annual Summer Instructional Technology Institute, conducted by Utah State University, will be held July 25-28, 1990 at Sherwood Hills Resort near Logan, Utah. Theme of the Institute is: "Automated Instructional Design." The program will feature descriptions and demonstrations of five major efforts to build intelligent computer-based instructional design systems. Others who are attempting to automate some aspect of the instructional design and development process are invited to submit short proposals to present their work at the Institute as well. Contact: M. David Merrill, Instructional Technology Department, Utah State University, Logan, Utah 84322.

- **Silicon Valley Training Programs.** A special institute dealing with training programs used in innovative high-tech companies in California's Silicon Valley will be held July 31-August 3, 1990 at San Jose State University, San Jose, California. Included in the program will be sessions on how useful practices of these companies might be transferred to schools and colleges as well as to other corporations. Contact: Dr. Jerrold F. Kemp, Department of Instructional Technology, San Jose State University, San Jose, California 95192.

- **Distance Learning Conference.** The Sixth Annual Conference on Distance Teaching and Learning will be held August 8-10, 1990 in Madison, Wisconsin. The conference is to examine how distance education is responding to social and technological changes. Contact: Chris Olgren, University of Wisconsin, 225 North Mills Street, Madison, Wisconsin 53706; (608) 262-5525.

- **European Training Technologies Conference.** The First Training Technologies for Competitiveness Conference will be held October 16-18, 1990 at The Hague, Netherlands. The event will concentrate on the improvement of performance among European businesses through the application of training technologies. Contact: Dr. Johan de Haas, Programme Secretariat, The Educational Computing Consortium, P.O. Box 217, 7500 AE Enschede, The Netherlands; telephone: 31 (0) 53 333367.

- **International Distance Education Conference.** The 15th World Congress of the International Council for Distance Education will take place November 4-10, 1990 in Caracas, Venezuela. The conference theme is: "Distance Education: Development and Access." Contact: Armando Villarroel, Oficina de la XV conferencia ICDE, Apartado 797, Caracas 1010A, Venezuela; 58-2-573-1346; Telex: 26111 UNA VC.