Introduction of Human Computer Interaction in Modern Education

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Abstract

The concept of HCI (Human Computer Interaction), in Adult Education is going to have a major impact on how adult learners are trained in the future. This paper will define HCI and present and introductory overview of the information in layman terms. This paper will give some of the history behind HCI, future developments in the area of HCI, content information of what HCI, example of designing HCI education, how it affects social aspects of both education and in the industry. Discuss how HCI can be effective in training children in early education and adults in continuing education. How best to come to terms with Social Constructivism and how it will best fit into the scheme of modern education and its impact on the future of education.

Keywords: HCI, human computer interaction, human learning, society, social constructivism

Defining Human Computer Interaction

There is currently no agreed upon definition of the range of topics which form the arena of HCI. Yet we need a characterization of the field if we are to derive and develop educational materials for it. Therefore here is what Hewett, (2002), offers as a working definition of HCI:

> "Human computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them". (Page 5)

Consider what is meant by the notion of human as a basis for designing computer programs or interfaces. If we allow the human to be a group of humans or an organization, we may consider interfaces for computers or the Internet as web sites. If we go further down this path to consider job design, the nature of work and the nature of human satisfaction, then computers will occasionally occur when they are useful to these ends. The Human Computer Interaction is only one supporting area among others in modern education.

Historical Roots

HCI arose as a field from the intertwined roots in computer graphics, operating systems, human factors, ergonomics, cognitive psychology, and the systems part of computer science. This led to the development of several human computer interaction techniques. Many of these techniques date from a thesis (Sutherland 1963), that essentially marked the beginning of interactive graphics and HCI. In a related set of developments there were attempts to pursue "man-machine symbiosis" (Licklider, 1960), the "augmentation of human intellect" (Engelbart, 1963), and the "Dynabook" (Kay and Goldberg, 1977). Out of this line of development came a number of important building blocks, such as the mouse, graphic displays, personnel computers, the MS Windows phenomena, and point and click editors (Baecker & Buxton, 1987).

Future Developments

Human computer interaction is, in the first instance, affected by the forces shaping the nature of future computing. (Gasen, 1996) These forces include:

- Decreasing hardware costs leading to larger memories and faster systems.
- Miniaturization of hardware leading to portability.
- Reduction in power requirements leading to portability.
- New display technologies leading to computational devices in new forms.

- Assimilation of computation into the environment (e.g., VCRs and television).
- Specialized hardware leading to rapid text search. (e.g. SAN's Storage Area Networks)
- Increasing innovation in input techniques (e.g., voice, touch and pen).
- Wider social concerns leading to improved access to computers by currently disadvantaged groups (e.g., young children, minorities, and the physically/visually disabled).

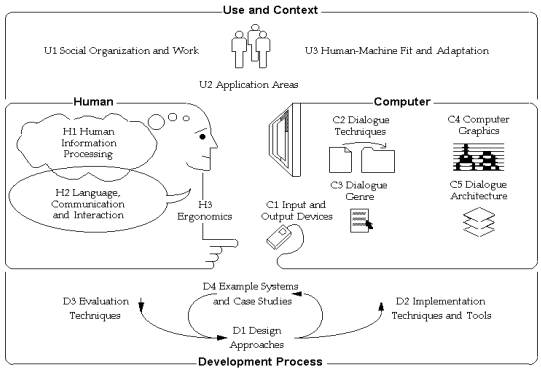
The Content of Human Computer Interaction

Some of the interrelationships among the topics of HCI are represented in Figure 1. Computer systems exist within a larger social, organizational and work environment. Within this context there are applications, for which we wish to employ computer systems, but the process of putting computers to work means the human, technical, and work aspects of the applications must be brought into each other through human learning, system tailor-ability, or some other strategies. In addition to the use and social context, the human information processing, communication, and physical characteristics of users, must be taken into account. All this is used in supporting interactions between humans and computers. The graphic in Figure 1 just gives us a glance at what HCI is all about, but what it does not show is the overall manner in which Human Computer Interaction is used everyway in today's society. You see it in grocery stores with hand held scanners, and the scanning of goods at checkout, the use of the debit card in purchases, without the need to exchange cash, upon a purchase. You see it more and more in banking; the 24-7 Web banking allows users to access their accounts, pay bills and even do their taxes for both state and federal governments. Since we will see more and more use of biometrics, whereby users can be scanned by thumb print or retina scan instead of using user ID's and passwords, as we do now, all this is part of Human Computer Interaction in society today (Dix, 1998).

The nature of HCI is to have different points of view:

- HCI as communication, agent paradigm, tool paradigm, the work centered point of view, human/system/tasks division, and supervisory control.
- Objectives (e.g., productivity, user empowerment).
- History and intellectual roots.
- HCI as an academic topic: journals, literature, relation to other fields, sciences, humanities, education and design aspects.

FIGURE 1. Human-Computer Interaction



Designing HCI Education

There are many scenarios describing education in the future: Not all learning will take place in schools. Courses will be of drastically different lengths. Learning will not end with a diploma. There will be less structured and codified ways of delivering education. There will be unique cooperation between academia and industry with new and continuing education as the goal. The design of life-long learning is the issue at hand (Boyarski, 1998).

We are currently constrained by an antiquated educational structure (Boyarski, 1998). This system is built on courses offered over semesters or quarters; on autonomous departments; and with an emphasis on individual faculty or student achievements. As a result, barriers exist to building courses outside of existing structures, to team teaching across departments, to supporting a range of topics, and to partnering with industry in the pursuit of collaborative projects, (Boyarski, 1998). Boyarski goes on to describe that those faculty who have successfully overcome these barriers point as enlightened participants within academia and industry. We can no longer continue to subscribe to outdated boundaries between disciplines. Instead, we should either cross these boundaries or transcend them. This suggests two concurrent paths for education: One is to explore collaborative methods that enable educators from different disciplines to apply themselves to new information related problems

with new information technologies; and second to build new educational programs for those who do not fit within current program boundaries, such as Adult Education. The challenge for education is this, how flexible can our educational structures be in order to support, even nurture, new ways of teaching tomorrow's students as well as adult learners (Boyarski, 1998)?

Social Organization and Work

Social organization relates to the human as an interacting social being. It includes a concern with the nature of work and with the notion that human systems and technical systems mutually adapt to each other and must be considered as a whole. Things to consider include points of view, models of human activity, and models of small groups, of organizations, of work, of workflow, of cooperative activity, and of office work. Other things to consider are socio-technical systems, human organizations as adaptive open systems, mutual impact of computer systems on work and vice versa for group tasks. And last the quality of work life and job satisfaction.

> "It is important to understand something about human information processing characteristics, how human action is structured, the nature of human communication, and human physical and physiological requirements," (Sears, 1997).

Here are some characteristics of the human as a processor of information:

- Models of cognitive architecture, such as symbol models, and connectionist models.
- Phenomena and theories of:
- Memory.
- Perception.
- Motor skills.
- Attention and vigilance.
- Problem solving.
- Learning and skill acquisition.
- Motivation.
- User's conceptual models.
- Models of human actions and input.
- Human diversity, including minorities, and disabled populations.

Children, Creativity and Computers

Druin (1997) asks what design methodologies are different when creating interfaces for children or adult learners. And what HCI skills may be needed that are different when designing for children and adults? From time to time, Druin (1997) suggests she will ask children to help her to design new interfaces for computers. Those kids, (Druin, 1997) taught me more than just what to do with technology. They also taught me, (Druin, 1997) that I had prejudices; one towards children that are extraordinarily pervasive among adults. I thought that children were simply *adults-in-waiting*. That they didn't have important things to say, children were just not as good as adults. I have come to see my prejudices (Druin, 1997) about children have taken on many forms. To begin with, there has been conceit (Hall, 1996, p. 155-156). "This is a form of prejudice where one group or person is thought to be better than another. This is a form where people can trivialize the importance of the other group's actions or behaviors, because these people are not seen as being as good." (Druin, 1997). It is wonderful to listen and learn from them the children, (Druin, 1997). Druin believes we really need to hear what our next generation is telling us, and if we listen hard enough, we might understand a little bit about the future. As new technologies become more common in our everyday lives, a greater number of educators in the HCI community will be called upon to design new technologies for our children. With this in mind, it is the hope of Druin, that the same will hold true for adult learners to question, consider, and introduce new ideas and approaches to Adult Education.

Curricula for Human Computer Interaction

New research results have been generated for this focus on curricula for HCI. However, there has been a shortage of educational materials for preparing courses in human computer interaction. At ACM (Association of Computing and Machines) workshop on curricula was held in 1985 (Mantei, 1985) and several instructors have published descriptions of their courses (e.g., Green, 1984; Hewett, 1987; Hix, 1990; Perlman, 1989; Strong, 1989; Verplank & Kim, 1987). The current level of activities and the development of studies in HCI is far enough along that the next step in developing educational programs is now possible. Penn State started its own program in HCI in 2001 and the department head is Dr. John Carroll. The time is appropriate to attempt initial inventories of the field and to make recommendations for education in HCI. To attempt such a project, the ACM formed a new

group, the Special Interest Group in Computer Human Interaction (SIGCHI), and also created a Curriculum Development Group (CDG) in 1988. The task of the committee was to produce a set of recommendations for education in HCI through ACM as a bulletin called the SIGCHI Bulletin.

HCI education has grown rapidly during the 1990's. Surveys of educators in the field indicate that an increasing number of courses are being offered in the field of HCI. In addition, greater emphasis is being placed on teamwork and inter-disciplinary collaboration (Gasen, 1995). Geared for higher education, some of the pioneer schools in the field of HCI are Carnegie-Mellon, University of Toronto, Virginia Tech, and others such as Penn State are now offering HCI courses through the School of Information Science and Technology with HCI being a separate department within the school.

Finally, an increased focus on educational processes and outcomes will be inevitable as we look for ways to be most effective in providing the best quality educational experience for both students and adult learners that can be achieved. Looking at how HCI education is influencing the careers and practices of both our graduates and adult learners should soon follow in government studies (Gasen, 1995). An expanded view of HCI in research includes research on knowledge acquisition, synthesis and dissemination along with research on educational impacts that will increase our understanding of the links between HCI research, education and practice (Gasen, 1995).

Coming to Terms with Social Constructivism

Social constructivist ideas about learning have direct implication for designing teaching practices and technology (Carroll, 2003). First designers should collaborate directly and deeply with computer experts. This means more than just knowledge engineering for a given domain. It means understanding teaching and learning in the domain (Carroll, 2003).

In 1995, Carroll and a group began long term collaboration with a public school system in southwestern Virginia to explore the feasibility of employing the Internet and forming what was a NSF (National Science Foundation) grant of $300,000, to create the "Networking Infrastructure for Education" initiative. What Carroll and his group created was LiNC, (Learning in a Networked Community). They worked with 6 teachers at several schools for 5 years involving more than 400 students.

Carroll's group further refined LiNC into a "Virtual School" on the Internet with an interactive web site that involved both the teachers and the students. In this virtual school each was to collaborate, share ideas, and formed a group chat tool so both teacher and student could discuss shared projects. The website was further refined to allow students the ability to write their own concepts in what was an individual work area, and then the students could share their projects and ideas with their teachers. If agreed upon the student concepts then would be taken from their work area to a production area to be made available to everyone using the web site. In a sense the students had a big stake in their education and could formulate ideas and find better ways of developing the web site to everyone's benefit both student and teacher. Thus this virtual school has become ongoing and self evolving, thus both student and teachers learn from each others collaborations.

Carroll took his group to a new level. From a student-teacher concept to a community wide cross-generational collaborative learning. Carroll (2003) states that many aspects of our work indicated that all can benefit from the technology and social infrastructure of what became known on the web as the, "Blacksburg Electronic Village" (Carroll, 2003, Page 24). This virtual web site allowed community leaders, senior citizens, adult workers and area school children learn through a virtual web site and learn visual simulations, programming techniques, chat rooms, and the ability of all to collaborate together. The group designed simulations that could be used to depict a community concern, such as fighting in the school yard, noise in the neighborhood, and so forth. It allowed an outlet for everyone to voice their concerns and share the news, thus increasing literacy skills and discussing different view points regarding the community in general and to calculate the community wellness by involving seniors, the disabled and other shut-ins who otherwise would not be involved with the community activities. (Rosen, 2003)

Summary

New participants, new initiatives, and new thinking are needed if the design disciplines are going to be contributors to the larger picture of

design in the Information Age. Change is imperative on three fronts. First, change is necessary in academia, not only within design education, but also with programs that are potential partners in collaborative projects and research. Second, change in thinking is needed with companies and institutions that may stand to gain from partnerships with academia in the form of sponsored projects or research. Third, change is imperative with funding agencies that fail to consider design programs at universities and college as recipients of major grants. There is serious ongoing work in various design programs around the country that can contribute to the general theme of product development in the area of smart products, software design, and information design. Put another way, the fruits of HCI's labor can be found in everyday products, for all kinds of people, doing a variety of tasks. What is common to the recommendations of universities and colleges is the need for support, in the form of equipment, electronic/digital links, and financial support for faculty and students. Visionary leaders within our schools, the government, and companies can make an enormous difference. Are we ready to take the next step?

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