Effective Use of HCI in e-Learning

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Abstract—E-learning is becoming globally widespread and more common. The usefulness of interactive systems in e-learning lies not in performing the processing task itself but in communicating requests and results between the system and its user. The best leverage for progress in this area therefore now lies at the user interface, rather than the system internals. Faster, more natural, and more convenient means for users and computers to exchange information are needed. On the user’s side, interactive system technology is constrained by the nature of human communication organs and abilities; on the computer side, it is constrained only by input/output devices and methods that we can invent. The challenge before us is to design new devices and types of dialogues that better fit and exploit the communication-relevant characteristics of humans.

Keywords—E-learning, HCI, perceptive interfaces, speech-based interface, vision-based interface.

I. INTRODUCTION

A. Human Computer Interaction (HCI)

It is the study of interaction between users and computers. It is often regarded as the intersection of computer science, behavioral sciences, design and several other fields of study. The Association for Computing Machinery defines HCI as "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." An important facet of HCI is the securing of user satisfaction.

A basic goal of HCI is to improve the interactions between users and computers by making computers more usable and receptive to the user’s needs. Specifically, HCI is concerned with:

- Methodologies and processes for designing interfaces
- Methods for implementing interfaces
- Techniques for evaluating and comparing interfaces
- Developing new interfaces and interaction techniques

A long-term goal of HCI is to design systems that minimize the barrier between the human’s cognitive model of what they want to accomplish and the computer’s understanding of the user’s task.

B. E-learning

It encompasses forms of technology enhanced learning (TEL) or very specific types of TEL such as online or Web-based learning. Nevertheless, the term does not have a universally accepted definition and there are divides in the e-learning industry about whether a technology enhanced system can be called e-learning if there is no set pedagogy as some argue e-learning is: "pedagogy empowered by digital technology".

As we move towards a world where information technology will affect almost any aspect of our life, the need arises for more intuitive ways of interacting with the computer and other electronic devices. From a technical point of view, it is already possible to implement interactions that exploit the perceptive abilities which we far
have characterized human-human communication only.

Perceptive user interfaces (also called perceptual user interfaces when integrated with multimedia output and other possible forms of multimodal input) try to provide the computer with perceptive capabilities, so that implicit and explicit information about the user and his or her environment can be acquired; the machine thus becomes able to “see”, “hear”, etc. Interface research is now moving towards several directions, and new and more natural input modalities will probably find application in graphical user interfaces (GUIs), joining and partly replacing traditional interaction paradigms based on keyboard and mouse.

In the e-learning context, the quality of the interaction is of paramount importance, as it directly influences the learning process by imposing specific communication modalities. Often, however, technologies employed are perceived by the use as unfriendly, “mysterious” and distant, lacking great part of the informal social interaction and face-to-face contact of traditional classroom training; undoubtedly, this is one of the main reasons that are put forward by detractors of e-learning to support their ideas. Inexperienced computer users suffer more from such drawbacks, but even those who daily work in the informatics field may undergo their negative effects.

II. RESEARCH ON HCI TECHNIQUES FOR E-LEARNING

In this paper, the application of perceptive interfaces to e-learning systems, as a way to improve the quality of the interaction through more natural forms of communication have been considered. Of course, it is practically impossible to achieve the levels of real human-human communication, but thanks to constant developments in the fields of computer vision and speech recognition, we will get closer and closer to such goal.

A. Research on Input Devices

1. Time stamping: This technique can be applied extensively to determine the time delays between the subsequent user responses and accordingly, judge the difficulty level of the question or the interest level of the user while answering the question or solving the problems.

2. Hand writing recognition: This type of interface can be helpful to reduce the use of keyboard, and hence minimizing the keystrokes, which often becomes tedious. This interface may facilitate an interaction through natural handwriting, which could be helpful in solving mathematical or logical or algorithmic type of problems. It could be of great use to the users not very efficient in typing skills.

3. Facial expression recognition: automatically identifying who is in front of the computer screen or distinguishing among different face expressions can help make the interface more “human like” (research in the affective computing area has shown that emotions may greatly influence the user’s behavior in the interaction with the computer). [5]

4. Voice: From voice it is possible to draw information about the emotional status of the user. Interfaces of this kind are useful to “humanize” the computer. Scientific findings suggest in fact an increasingly large number of important functions of emotions, which contribute not only to irrational behavior, but also play an important role in rational decision making. [5]

5. Three-dimensional pointing and manipulation: A magnetic tracker (e.g., Polhemus), can provide the three-dimensional analogue of the mouse. Other technologies, such as ultrasonic ranging or video tracking, can also be used in this way. Camera-based locator devices are being studied, but are still limited. A single-camera system is
limited to its line of sight; more cameras can be added but full coverage of an area may require many cameras and a way to switch among them smoothly. This approach requires some type of image processing to interpret the picture of the user and extract the desired hand or body position.

6. **General gesture input**: The three-dimensional mouse can be taken a step further. Rather than simply designating a location in three-space, it can allow a user to make natural, continuous gestures in space. Progress in this area requires not only a non-encumbering three-dimensional tracking technology but also a way to recognize human gestures occurring dynamically. Gesture based input is currently becoming a very active research area.

7. **Speech**: Speech input has been a long-standing area of research. While progress is being made, it is slower than optimists originally predicted, and further work remains in this field. Although the goal of continuous speech recognition remains elusive, unnatural, isolated-word speech recognition is appropriate for some tasks. Research is needed not only in the actual speech recognition technology but also in how to use speech in an interface.

8. **Eye input technology**: The eye movement input is, ideally a noncommand-based style technique. The problem with a simple implementation of an eye tracker interface is that people are not accustomed to operating devices simply by moving their eyes. They expect to be able to look at an item without having the look cause an action to occur. At first it is helpful to be able simply to look at what you want and have it occur without further action; soon, though, it becomes like the Midas Touch. Everywhere you look, another command is activated; you cannot look anywhere without issuing a command. To avoid this problem or some form of "clutch" to engage and disengage the monitoring.

9. **Passive monitoring of user attitude**: A user-computer dialogue could be improved if the computer knew the answer to such simple questions as, Is the user still sitting in his chair? Is he facing toward the computer? Is he using the telephone? Is another person present in the room? Real-world objects can do useful things when they detect even simple events like user arrival and departure.

10. **Fingerprint recognition**: The technology can be utilized to authenticate a user, which could prove to be useful while examining or evaluating a user.

**B. Research on Output Devices**

1. **Better graphics resolution**: While great strides have been made in graphical output resolution, the demands of high-performance user interaction are far from satisfied. People can routinely make effective use of densely packed documents such as a printed road map or navigational chart. Their high resolution is well matched to human perceptual abilities, yet it is well beyond the current state of practice in display technology.

2. **Touchable three-dimensional displays**: A further improvement in the realism of a three-dimensional display would be to permit the user to reach out and feel the displayed object. Force and resistance feedback are discussed below; they derive particular power when combined with a convincing stereoscopic display.

3. **Non-speech audio output for ‘visualizing’ data**: It is not necessary to restrict the notion of "visualization" to visual displays. The basic idea of visualization is to put data into some
representation perceptible to the user. This representation could be entirely visual or visual plus, for example, audio or not visual at all (tactile plus audio). For example, a useful means for encoding information is in sounds. Typical computer systems use only a few simple beeps for alerts, but humans can glean considerably more meaning from simple sounds, both natural sound effects and artificially conceived tones. [11][14][15]

4. **Speech**: Natural, continuous speech output is difficult to achieve, but simple, isolated utterances may still be reasonable when talking with a computer. Much of the discussion under speech for input, above, applies here too, and, again, research in how to use speech and integrate it into a multimode interface is particularly important.

5. **Ergonomic considerations**: In a different direction, less tiring output media will become increasingly important as users spend more of their lives receiving computer output. CRT displays continue to elicit complaints of muscle fatigue, eye fatigue, and the like. While some of these seem to be caused by factors outside the display device, such as poor job design and poor seating posture, some may also be caused by the actual characteristics of the device. Better alternatives would be worthwhile.

6. **Colour**: Except where photographs are used or realistic pictures are required, screens limited to three or four colours work best. A **high contrast colour** between background and text facilitates reading and can improve performance on tasks such as recall and retention of information. However, colour is important for motivation, particularly where younger children are concerned, so the use of black and white screens is not generally advised. Be careful when choosing colours, as users with visual impairments such as colour blindness will have difficulties with certain colour combinations. [6]

7. **Video**: Screens containing video need control buttons for the learner. They need to be able to rewind, repeat the video from the beginning and stop at any particular point. Make sure the buttons and their functionality are obvious by convention or design. [6]

8. **Text**: Pay attention to the size and type of font and the area of the screen used for text. Make sure the level of difficulty of the language used is appropriate for your target learner and sentence lengths are kept short for improved **readability**. [6]

9. **Images**: Select appropriate photographs, graphics and animations with the learning task and age of the audience in mind. These will influence the **ambience** of the learning material and will affect the appeal of the program, helping to give it its ‘character’. [6]

10. **Balance**: The screen should be pleasing to the eye, which often means some sort of symmetry in the layout and an appropriate balance between text and graphics. If clarity and simplicity are required, the text should only occupy a reasonably small portion of the page and screens should not be too busy or ‘loud’. For learning purposes grouping or chunking together of material for specific learning points is desirable. [6]

### III. CONCLUSION

Research in new input/output devices and interaction styles for interactive systems can lead to two kinds of benefits. The first is progress in our scientific understanding of human computer communication: it can improve our understanding of new modes by which people can communicate with machines and lead to understanding of the characteristics of the devices, interaction techniques, and dialogue styles that allow us to exploit these modes. The second is in application of these results: it can lead to
faster and more natural communication with interactive systems, enable better quality and efficiency in the operation of such systems, and improve the working conditions of their users by providing them with richer and more natural means of communication.

In this paper we have discussed about the possible use of HCI in advanced e-learning systems to achieve better levels of interaction between user and the computer. Even if except for very rare cases, such systems have so far not been considered in the virtual teaching realm, now the time is probably ripe for them to be taken into serious account. Beyond their effectiveness in improving the interaction with the computer, we think that their forte lies in the ability to be felt as more natural communication ways by the user.

User involvement and iterations of user testing are strongly recommended to get the layout correct. The input of sample learners at an early stage is well worth investing in so that you have information on how others see and operate your screens. In this way, you can eliminate any assumptions you may have about how the interface works, which may not be apparent to the user.

REFERENCES:

