A Brief Survey of HCI Technology

Lecture #3

Agenda

- Evolution of HCI Technology
  - Computer side
  - Human side
- Scope of HCI

HCI: Historical Perspective

- **Primitive age**
  - Charles Babbage's computer
  - Punch card
  - Command line

HCI: Spectacular Growth

- **Spectacular growth started since 1985**
  - Ubiquitous graphical user interface
    - e.g. Microsoft Windows 95
  - Recent trend in software industries to employ user interface toolkit, interface builder
    - e.g. Java AWT, Java Swing, Microsoft's Visual Studio etc.
  - A revolutionary development in WWW is a direct consequence of HCI results

Interaction Styles: Computer Side

- **Computer Graphics**

  (was born from the use of CRT and Pen device)

  - Pioneered by Ivan Sutherland (MIT, 1963) in *Sketchpad*

  - This leads to the development of several human-computer interaction techniques
    - User friendly drawing, CAD/CAM, Video games etc.

Interaction Styles: Computer Side

- **Point-and-click devices**
  - Mouse, Tablet, Joystick etc.
  - Mouse was developed at Stanford Research Laboratory (now SRI) in 1965
  - Development of the mouse gave rise to point-and-click style in today's interactions
    - All pervasive
    - Most sophisticated input device and alternative to the keyboard

Interaction Styles: Computer Side

- **Object-oriented interaction**
  - Multiple-tiled windows proposed by Alan Kay (University of Utah, 1969)
  - Widget from William Newman (Imperial College, London, 1970)
  - Icon (engineered by David Canfield Smith, Stanford Research Laboratory, 1975)
  - WYSIWYG (What You See Is What You Get – pioneered by Xerox PARC, 1977)

  Supports user-centered tasks, system management, document preparation etc.

Interaction Styles: Computer Side

- **Hypermedia style**
  - Hypertext, hyper-video, hyper-image etc.
  - Facilitate navigation type interaction style giving a flavor of dynamic/multidimensional browsing
  - A de facto style in web-based applications

Note: Years indicate when the research results for an interaction styles first reported. Actually, they were commercialized around 1985 and onwards.

For details see: A Brief History of Computer Interaction Technology, Brad A. Myers, ACM Interactions, Vol. 5, No. 2, March 1998, pp. 44-54

Interaction Styles: Computer Side

- Several other interaction styles are still under research, particularly in the following application areas
  - Multimedia systems (1995)
  - Virtual reality and augmented reality (1996)
  - Computer supported cooperative work (CSCW) (1995)
  - 3D graphics and animations (1995)
  - Natural language processing and speech (1994)
  - Automatic programming (1997)
  - Multi-modal applications (1993)

Software Tools for Interactions

- The area of user interface tool is quite active now. Many software tools are available in the market as well as free products. Few generic tools are:

  - UIMS and Toolkit
    - These are software libraries and tools that support creating interfaces by writing code
    - William Newman in Imperial College, London first time proposed (1967) the concept of User Interface Management Systems and Toolkit

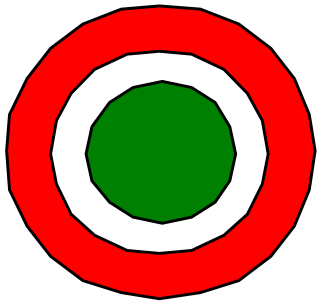
Software Tools for Interactions

- Interface Builders
  - Theses are interactive tools that allow interfaces composed of widgets, such as button, menus and scrollbars to be placed using a mouse
  - Microsoft's Visual Studio is a very popular one of this kind

Note: UIMS & Toolkit and Interface Builders also take operating systems into considerations for developing techniques for interfacing output devices, for tuning system response time to human interaction times, for multiprocessing and multitasking, for supporting windowing environments and animation etc.

Software Tools for Interactions

- Component Architectures
  - These are the concept of component object model (COM) to create interfaces by connecting separately written components
  - Some popular such technologies are from the houses of Apple, Microsoft like
    - Microsoft's OLE
    - Apples' OpenDoc architecture etc.



HCI Technology: Human Side

The present HCI technology also has evolved with human side development, such as, in the field of psychology, design, human factors and ergonomics

- Human factors as a discipline, derives from the problems of designing equipments operable by human. This first came into consideration during World War II

- Since then many development has observed, particularly in sensory-motor features

    - Design of flight displays and controls
    - Pattern of keys in keyboard
    - Keypad in cello phone

HCI Technology: Human Side

- Ergonomics (it is the study of people and their working conditions) is similar to human factors but it arose from studies of works
  - Ergonomics also has evolved as a study of physiological aspects
  - Some work have been reported those deal with stress, posture, gesture etc.
- Perception and cognition are the two natural extensions of human interaction with computers
  - Cognitive engineering is not as such matured and yet to be addressed from the interaction point of views

References: For Detail Study

1. To Dream the Possible Dream, R. Reddy, Communication of the ACM, 1996, Vol. 39(5), pp. 105-112

2. Pygmalion: A Computer Program to Model and Stimulate Creative Thought, D. C. Smith, 1977, Ph.D. thesis, Stanford University, Computer Science Department

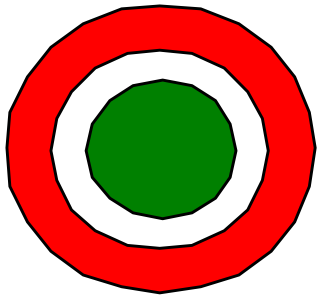
3. Readings on Human factors in Computer Systems, P. Green, ACM SIGCHI Bulletin (1989), Vol. 21(4), pp. 20-26

4. The MIT Encyclopedia of the Cognitive Science, Wilson, Keil, MIT Press, 2001, Cambridge

5. Cognitive Aspects of Visual Languages and Visual Interfaces, M. J. Tauber, D. E. Mahling & F. Arefi, Human Factors in Information Technology, Vol. 11, 1994, North-Holland, Amsterdam, Elsevier Science B. V.

6. The Psychology of Human Computer Interaction, S. K. Card, T. P. Moran, A. Newell, 1983, Hillsdale, Lawrence Erlbaum associates, New Jersey

7. An Introduction to Experimental Design in Psychology: A Case Approach (3rd Edn.) R. L. Solso, H. H. Johnson, 1984, Harper & Row, New York



Scope: Why HCI?

The means by which human interact with computers continues to evolve rapidly. The forces behind this rapid development are the following:

- Decrease hardware cost 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 the packaging of computational devices in new forms
- Assimilation of computation into the environment (e.g. VCRs, Televisions, Microwave ovens, Washing machines etc.)

Scope: Why HCI?

- Specialized hardware leading to new functions (e.g. rapid text search)
- Increased development of network communication and distributed computing
- Increasingly widespread use of computers, especially, by people who are outside of the computing profession
- Increasing innovation in input techniques (e.g. voice, gesture, posture, pen) combine with lowering cost, leading to rapid computerization among common people
- Wider social concerns leading to improved access to computers by currently disadvantaged groups (e.g. young children, the physically/visually disabled etc.)

Scope: Where is HCI?

- Based on the trend and emergence of IT, following are the few areas where HCI has potential usage:
  - Ubiquitous communication
    - Computers will communicate through
      - High speed local area networks
      - Nationally over wide-area networks
      - Portably via infrared, ultrasonic cellular and other technologies
    - Data and computer services will be portably accessible from many location to which a user travels

Scope: Where is HCI?

- **High functionality systems**
  - Systems will have large number of functions associated with them
  - There will be so many systems that most users, technical or non-technical, will not have time to learn them in the traditional ways (e.g. on-line help, thick manuals)
- **Mass availability of computer graphics**
  - Computer graphics capabilities, such as, image processing, graphics transformations, rendering, and interactive animation (animated games)
  - Inexpensive chip will accelerate the usability

Scope: Where is HCI?

- **Mixed media**
  - System will handle images, voices, sounds, videos, text formatted data
  - These will be exchangeable over communication links among users
  - The separate world of consumer electronics (stereo, DVD, TV etc.) and computers will partially merge
  - Printing technology with computer (computer and print worlds will continue to cross assimilate each other)

Scope: Where is HCI?

- **High-bandwidth applications**
  - The rate at which humans and machines interact will increase substantially due to the changes in speed, computer graphics, new media, and new input/output devices
  - This will lead to some qualitatively different interfaces, such as, virtual reality or computational videos

Scope: Where is HCI?

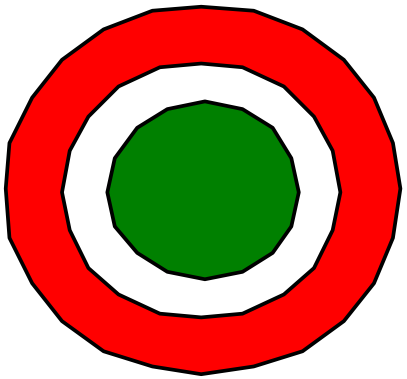
- **Large and thin displays**
  - New display technology will finally mature enabling very large displays and also displays that are thin, light weight, and have low power consumption
  - This will have large effects on portability and will enable the development of paper-like, pen-based computer interaction systems

Scope: Where is HCI?

- **Embedded computation**
  - Computation will pass beyond desktop computers into every object for which uses can be found
  - Networked communication will allows many of these embedded computations to coordinate with each other and with the user
  - Human interfaces to these embedded devices in all these cases will be highly credential

Scope: Where is HCI?

- **Group interfaces**
  - Interfaces to allow groups of people to coordinate (e.g. for meetings, for engineering projects, for authoring joint documents etc.)
  - Models of the group design process will be embedded in the systems
  - Will cause increased rationalization design



Recommended Materials

- My Home page
  http://www.facweb.iitkgp.ernet.in/~dsamanta
  (For the presentation slides of the current lecture and the .pdf version of the paper "A Brief History of Human Computer Interaction Technology" by Brad A. Myers)

- ACM SIGCHI
  http://sigchi.org/cdg/index.html
  (For the "Scope of HCI" see Chapter 2 in the page)