

Lecture 4

Human Computer Interaction

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1. User interface as means of human-computer interaction. Usability of interfaces.
2. Types of interfaces: command line interface, text interface, graphic interface.
3. Physical and mental characteristics of the user. Development stages of the user interface. Types of testing of interfaces. Perspectives of development of interfaces.
4. Number system.

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.
- ▶ ACM SIGCHI Curricula for HCI
<http://sigchi.org/cdg/cdg2.html>

Why HCI is Important

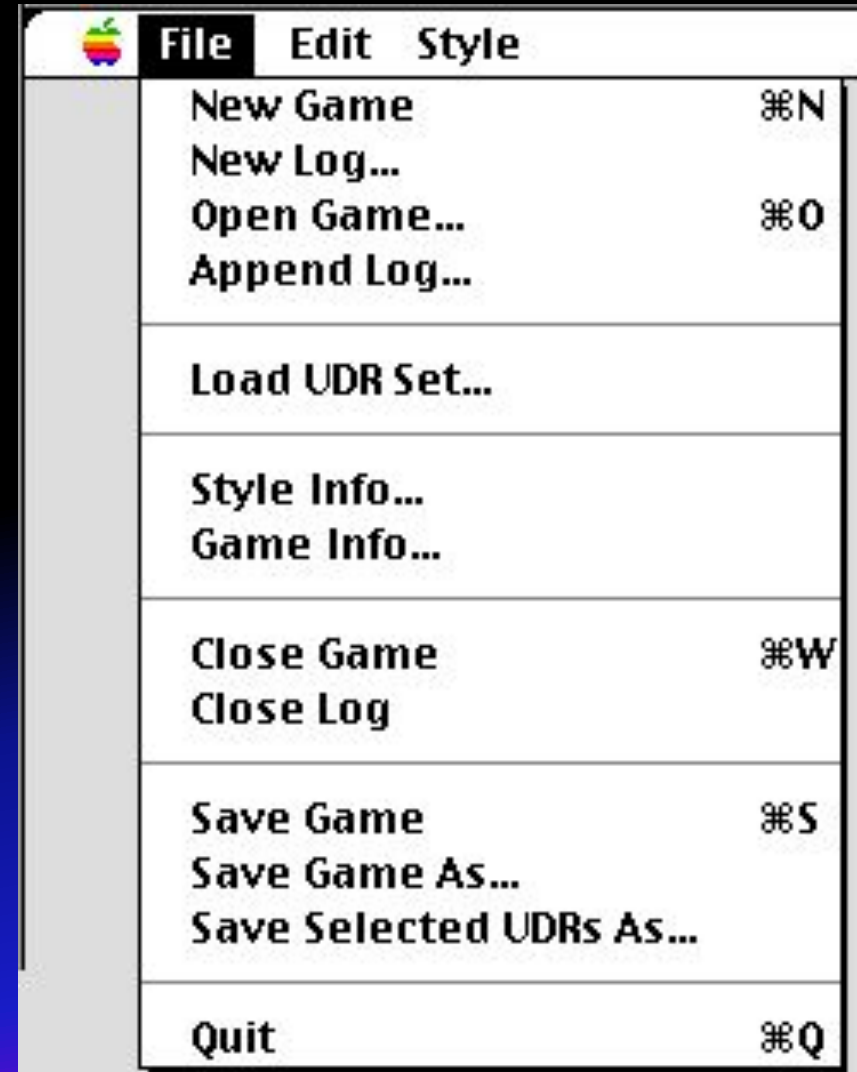
- ▶ The study of our interface with information.
- ▶ It is not just 'how big should I make buttons' or 'how to layout menu choices'
- ▶ It can affect
 - Effectiveness
 - Productivity
 - Morale
 - Safety
- ▶ Example: a car with poor HCI
- ▶ Take 5 minutes for everyone to write down one common device with substantial HCI design choices and discuss with the neighbor the pros and cons. How does it affect you or other users?

What fields does HCI cover?

- ▶ Computer Science
- ▶ Psychology (cognitive)
- ▶ Communication
- ▶ Education
- ▶ Anthropology
- ▶ Design (e.g. graphic and industrial)

HCI Community

- ▶ Academics/Industry Research
 - Taxonomies
 - Theories
 - Predictive models
- ▶ Experimenters
 - Empirical data
 - Product design
- ▶ Other areas (Sociologists, anthropologists, managers)
 - Motor
 - Perceptual
 - Cognitive
 - Social, economic, ethics



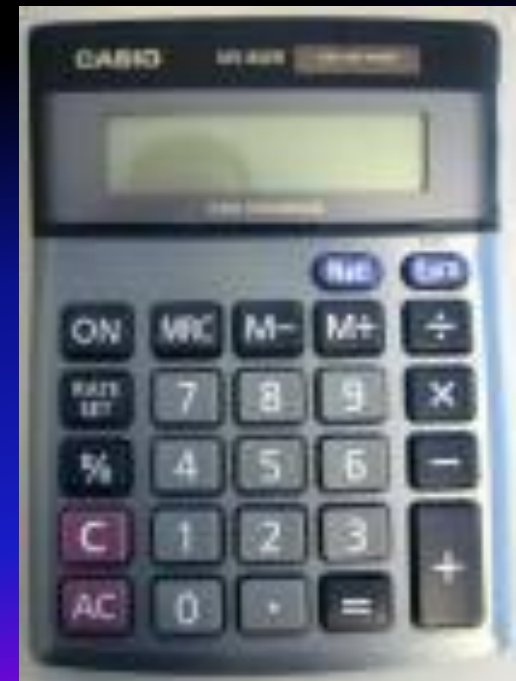
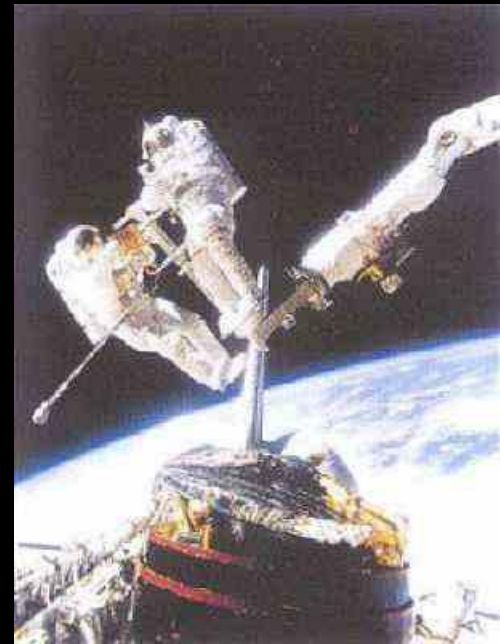
Usability Requirements

- ▶ Goals:
 - Usability
 - Universality
 - Usefulness
- ▶ Achieved by:
 - Planning
 - Sensitivity to user needs
 - Devotion to requirements analysis
 - Testing



Ascertain User's Needs

- ▶ Define tasks
 - Tasks
 - Subtasks
- ▶ Frequency
 - Frequent
 - Occasional
 - Exceptional
 - Repair
- ▶ Ex. difference between a space satellite, car engine, and fighter jet



Reliability

- ▶ Actions function as specified
- ▶ Data displayed must be correct
- ▶ Updates done correctly
- ▶ Leads to trust! (software, hardware, information) – case: Pentium floating point bug
- ▶ Privacy, security, access, data destruction, tampering



Standardization, Integration, Consistency, Portability

- ▶ **Standardization** – common user-interface features across multiple applications
 - Apple
 - Web
 - Windows
- ▶ **Integration** – across application packages
 - file formats
- ▶ **Consistency** – common action sequences, terms, units, layouts, color, typography within an application
- ▶ **Portability** – convert data and interfaces across multiple hardware and software environments
 - Word/HTML/PDF/ASCII

Usability Motivations

- Time to learn
- Speed of performance
- Rate of errors
- Retention over time
- Subjective satisfaction

▶ Life-Critical systems

- **Applications:** air traffic, nuclear reactors, military, emergency dispatch
- **Requirements:** reliability and effective (even under stress)
- **Not as important:** cost, long training, satisfaction, retention

▶ Industrial and Commercial Use

- **Applications:** banking, insurance, inventory, reservations
- **Requirements:** short training, ease of use/learning, multiple languages, adapt to local cultures, multiplatform, speed

▶ Office, Home, and Entertainment

- **Applications:** E-mail, ATMs, games, education, search engines, cell phones/PDA
- **Requirements:** Ease of learning/use/retention, error rates, satisfaction
- **Difficulties:** cost, size

Usability Motivations

- Time to learn
- Speed of performance
- Rate of errors
- Retention over time
- Subjective satisfaction

► Exploratory, Creative, Collaborative

- **Applications:** Web browsing, search engines, simulations, scientific visualization, CAD, computer graphics, music composition/artist, photo arranger (email photos)
- **Requirements:** remove the 'computer' from the experience,
- **Difficulties:** user tech savvy-ness (apply this to application examples)

► Socio-technical systems

- **Applications:** health care, voting, police
- **Requirements:** Trust, security, accuracy, veracity, error handling, user tech-savvy-ness

Children

- ▶ Technology saviness?
- ▶ Age changes much:
 - Physical dexterity
 - ▶ (double-clicking, click and drag, and small targets)
 - Attention span
 - (vaguely) Intelligence
- ▶ Varied backgrounds (socio-economic)
- ▶ Goals
 - Educational acceleration
 - Socialization with peers
 - Psychological - improve self-image, self-confidence
 - Creativity – art, music, etc. exploration



Children

- ▶ Teenagers are a special group
 - Next generation
 - Beta test new interfaces, trends
 - Cell phones, text messages, simulations, fantasy games, virtual worlds
- ▶ Requires Safety
- ▶ They
 - Like exploring (easy to reset state)
 - Don't mind making mistakes
 - Like familiar characters and repetition (ever had to babysit a kid with an Ice Age DVD?)
 - Don't like patronizing comments, inappropriate humor
- ▶ Design: Focus groups



Accommodating Hardware and Software Diversity

- ▶ Support a wide range of hardware and software platforms
- ▶ Software and hardware evolution
 - OS, application, browsers, capabilities
 - backward compatibility is a good goal
- ▶ Three major technical challenges are:
 - Producing satisfying and effective Internet interaction (broadband vs. dial-up & wireless)
 - Enabling web services from large to small (size and resolution)
 - Support easy maintenance of or automatic conversion to multiple languages

HCI Goals

- ▶ **Influence academic and industrial researchers**
 - Understand a problem and related theory
 - Hypothesis and testing
 - Study design (we'll do this!)
 - Interpret results
- ▶ **Provide tools, techniques and knowledge for commercial developers**
 - competitive advantage (think ipod)
- ▶ **Raising the computer consciousness of the general public**
 - Reduce computer anxiety (error messages)
 - Common fears:
 - ▶ I'll break it
 - ▶ I'll make a mistake
 - ▶ The computer is smarter than me
 - HCI contributes to this!

Human–computer interaction

(commonly referred to as **HCI**)

researches the design and use of computer technology, focused on the interfaces between people (users) and computers. Researchers in the field of HCI both *observe* the ways in which humans interact with computers and *design* technologies that let humans interact with computers in novel ways.

- ▶ Humans interact with computers in many ways; and the interface between humans and the computers they use is crucial to facilitating this interaction. Desktop applications, internet browsers, handheld computers, and computer kiosks make use of the prevalent graphical user interfaces (GUI) of today.

The human–computer interface can be described as the point of communication between the human user and the computer. The flow of information between the human and computer is defined as the *loop of interaction*.

The loop of interaction has several aspects to it, including:

- ▶ Visual Based :The visual based human computer inter-action is probably the most widespread area in HCI research.
- ▶ Audio Based : The audio based interaction between a computer and a human is another important area of in HCI systems. This area deals with information acquired by different audio signals.

The loop of interaction has several aspects to it, including:

- ▶ *Task environment*: The conditions and goals set upon the user.
- ▶ *Machine environment*: The environment that the computer is connected to, e.g. a laptop in a college student's dorm room.
- ▶ *Areas of the interface*: Non-overlapping areas involve processes of the human and computer not pertaining to their interaction. Meanwhile, the overlapping areas only concern themselves with the processes pertaining to their interaction.

The loop of interaction has several aspects to it, including:

- ▶ *Input flow*: The flow of information that begins in the task environment, when the user has some task that requires using their computer.
- ▶ *Output*: The flow of information that originates in the machine environment.

The loop of interaction has several aspects to it, including:

- ▶ *Feedback*: Loops through the interface that evaluate, moderate, and confirm processes as they pass from the human through the interface to the computer and back.
- ▶ *Fit*: This is the match between the computer design, the user and the task to optimize the human resources needed to accomplish the task.

2. Types of interfaces: command line interface, text interface, graphic interface.

There exist several types of user interfaces.

Command-Line Interface (CLI): The user provides the input by typing a command string with the computer keyboard and the system provides output by printing text on the computer monitor .


```
C:\Windows\system32\cmd.exe
16/12/2010 12:57          41 .gitconfig
24/02/2012 21:31      <DIR> .idlerc
31/10/2011 02:08      <DIR> .jdkreport
21/05/2012 10:16      <DIR> .VirtualBox
13/01/2012 00:13      <DIR> Adobe Flash Builder 4.5
23/12/2010 13:32      <DIR> Calibre Library
15/02/2012 20:46      <DIR> Contacts
22/05/2012 16:49      <DIR> Desktop
13/04/2012 10:06      <DIR> Documents
19/03/2012 00:14      <DIR> Downloads
15/02/2012 20:46      <DIR> Favorites
07/12/2011 11:25    60,304 g2mdlhlpx.exe
15/02/2012 20:46      <DIR> Links
15/02/2012 20:46      <DIR> Music
16/04/2012 15:04      <DIR> Pictures
15/02/2012 20:46      <DIR> Saved Games
15/02/2012 20:46      <DIR> Searches
15/02/2011 04:23          0 Sti_Trace.log
15/02/2012 20:46      <DIR> Videos
15/02/2012 20:46      <DIR> Virtual Machines
13/04/2011 04:13      <DIR> VirtualBox VMs
          3 File(s)          60,345 bytes
         22 Dir(s)  821,324,812,288 bytes free
```

Fig 1. A Command Line Interface.

Text interface with menus

- ▶ A text interface can be made easier to navigate using menus created with text and ASCII extended characters. For example, many command line text editors have some type of interface with menus and shortcut keys that make navigating the file being edited easier.

WIMP or GUI Interface

- ▶ A graphical user interface (GUI) is the most common type of user interface in use today. It is a very 'friendly' way for people to interact with the computer because it makes use of pictures, graphics and icons - hence why it is called 'graphical'.
- ▶ A GUI (pronounced gooey) is also known as a WIMP interface because it makes use of: **Windows, Icons, Menus, Pointers.**

3. Physical and mental characteristics of the user. Development stages of the user interface. Types of testing of interfaces (testing of users). Perspectives of development of interfaces.

- ▶ The system that people use to interact with a computer (to give it commands, to see the results of those commands, etc.) is known as the **user interface**.

Graphical user interface

- ▶ In computer science In computer science, a graphical user interface, is a type of user interface In computer science, a graphical user interface, is a type of user interface that allows users In computer science, a graphical user interface, is a type of user interface that allows users to interact with electronic devices In computer science, a graphical user interface, is a type of user interface that allows users to interact with electronic devices through graphical icons In

Post-WIMP interfaces

- ▶ Smaller mobile devices such as personal digital assistants Smaller mobile devices such as personal digital assistants (PDAs) and smartphones typically use the WIMP elements with different unifying metaphors, due to constraints in space and available input devices.

Operating system command-line interfaces

- ▶ A program that implements such a text interface is often called a command-line interpreter, command processor or shell.

Application command-line interfaces

- ▶ Application programs (as opposed to operating systems) may also have command line interfaces.
- ▶ An application program may support none, any, or all of these three major types of command line interface mechanisms.

Sound and speech interface

- ▶ This type of interface allows the user to speak or type in their normal everyday language in order to interact with the computer.

4. Number system

TYPES OF NUMBER SYSTEM

There are two types of number systems:-

=> Positional number systems

=> Non positional number system

Non Positional Number Systems

Characteristics:-

- => Use symbols such as I for 1, II for 2, III for 3,IIII for 4, etc.**
- => Each symbol represents the same value regardless of its position in the number system.**
- => The symbols are simply added to find out the value of the number concerned.**

POSITIONAL NUMBER SYSTEM

Characteristics:-

=>This system uses only a few symbols called digits.

=> These symbols represent different values depending upon the position they occupy in the number.

=>The maximum value of a single digit is equal to one less than the value of base.

COMMON NUMBER SYSTEMS

System	Base	Symbols	Used by humans?	Used in computers?
Decimal	10	0, 1, ... 9	Yes	No
Binary	2	0, 1	No	Yes
Octal	8	0, 1, ... 7	No	No
Hexa-decimal	16	0, 1, ... 9, A, B, ... F	No	No

Decimal Number System

Characteristics:-

=> It is a positional number system.

=> It has 10 symbols or digits(0-9).

=> The maximum value of a single digit is 9.

Binary Number System

Characteristics:-

=> It is a positional number system.

=> It has only two symbols or digits.

=>The maximum value of a single digit is 1.

EXAMPLE OF BINARY SYSTEM

Ex:- **101012**

$$\Rightarrow (1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0)$$

$$\Rightarrow 16 + 0 + 4 + 0 + 1$$

$$\Rightarrow 2110$$

Octal Number System

Characteristics :-

=> It is a positional number system.

=> It has 8 symbols or digits.

=> The maximum value of a single digit is 7.

THANK YOU!