

BACHELOR OF TECHNOLOGY

SEMESTER - VII

HUMAN COMPUTER INTERACTION TCS756

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Course Outcomes

- CO-1. Explain the capabilities of both humans and computers from the viewpoint of human information processing
- CO-2. Describe typical Human-Computer Interaction (HCI) models, styles, and various historic HCI paradigms
- CO-3. Apply an interactive design process and universal design principles to designing HCI systems



Course Outcomes

- CO-4. Describe and use HCI design principles, standards and guidelines
- CO-5. Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems
- CO-6. Discuss tasks and dialogs of relevant HCI systems based on task analysis and dialog design

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UNIT 1 Introduction to HCI

Importance of User Interfaces

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Unit Outcomes

- Discuss about User Interface and its various components
- Discuss the history of screen design
- List the different interaction styles
- Describe the concept of Direct Manipulation
- Explain the different characteristics of a Web Interface
- List the Principles of User Interface Design

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Basics of HCI

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Introduction

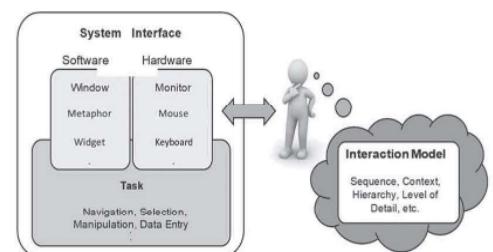
- Human–Computer Interaction (HCI) is the study of the interaction between humans and computers and the design of computing technologies
- It deals with the study, planning, design, implementation, and evaluation of how people and computers work together to meet person's requirement in the most effective way
- It overlaps user-centered design, user interface design, and user experience design

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- Interaction is an abstract model used to build systems where humans interact with the computing device for a given task
- An interface is a hardware or software used to implement a given interaction model



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Introduction

- HCI includes two important functionalities:
 - It makes the necessary computational functionalities available
 - It provides an interaction model and helps to implement interfaces for high usability
- Usable and efficient interaction with the computing device results in higher productivity

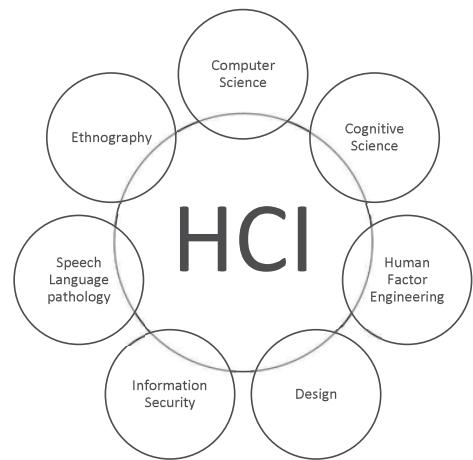
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HCI Components

- HCI includes components of three domains i.e., Computer Science, Human Factor Engineering (HFE) and Cognitive Science
- Computer science is the study of processes that interact with data in the form of programs



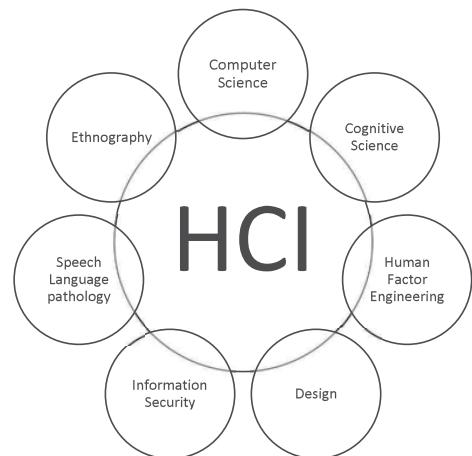
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HCI Components

- Human Factor Engineering (HFE) deals with the study of how people use systems or equipment for designing, developing, and creating technology that is safer and more effective
- Cognitive Science is the study of the mind, intelligence, and learning which includes research in psychology, philosophy, linguistics, and artificial intelligence



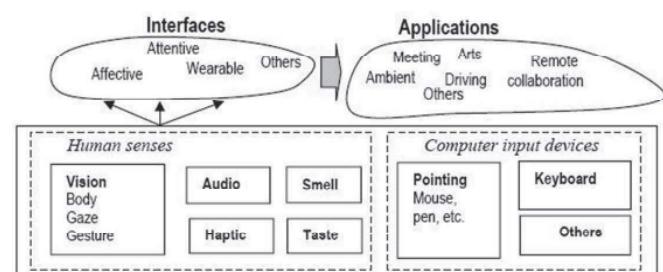
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Multimodal HCI Implementation

- A Multimodal HCI system is one that responds to inputs in more than one modality or communication channel
- It uses more than one independent channel signals to interact between humans and computers



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Factors to be considered by HCI designers:

- The two important terms that should be considered in the design of HCI are **functionality** and **usability**
- **Functionality** defines a set of actions or services that it provides to its users
- **Usability** of a system with a certain functionality is the range and degree by which the system can be used efficiently and adequately to accomplish certain goals for certain users



The HCI designers should have a proper understanding of the following:

- **Users' requirements and expectations**
- **Working of their information processing systems**
- **Physical limitations and abilities of the users**
- **The way to make users enjoy the experience of using computer**
- **Technical characteristics and limitations of computer hardware and software**



Importance of a Good design

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Definition – User Interface (UI)

- The user interface is a subset of HCI and forms a part of the computer and its software that users can see, hear, touch, and talk to.

Components of User Interface:

UI has two main components i.e., input and output

- The user communicates his or her needs to the computer through the input devices such as keyboard, mouse, trackball, one's finger (touch-sensitive screens), one's voice (microphone)

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Importance of a Good Design

- The computer conveys its computational results to the users using output devices such as display screens, speakers etc.
- The screen and the interface are the only visible components for a developer to create a product
- User Interface need to be designed well because of the following reasons:
 - All the capabilities of the system can be viewed on the screen through the interface

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Importance of a Good Design

- They form a bridge between the user and the software
- They form a vehicle through which critical tasks are presented and that would affect the organization's relations with its customers and its profitability
- A bad screen layout and appearance with system navigation may confuse the users
- Poor design may lead to stress or frustration and the users might stop using the system permanently

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Importance of a Good Design

- Poor interface design can result in huge financial loss to both customers and organizations



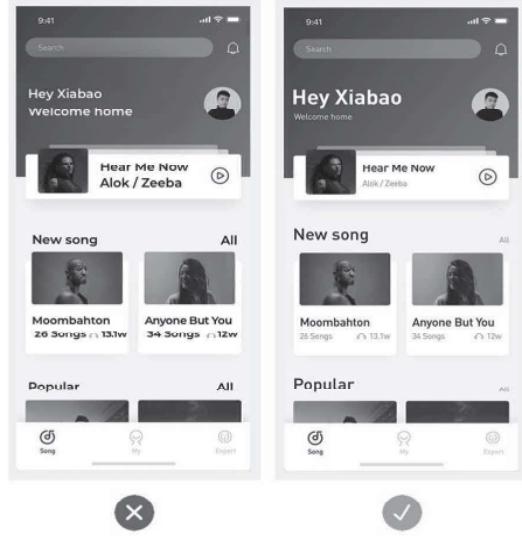
Good and Poor Design

Every application is different and there are no rules or standard formulae for creating a perfect user interface. But certain things need to be considered while designing the UI to ensure usability. Following design issues need to be addressed to have better UI design.

- **Lack of text hierarchy:** Text is the primary unit of informational content, so it must always be legible, organized, and comprehensible. For the better perception of information by the users, the text needs to be formatted.



Good and Poor Design



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Good and Poor Design

- **Confusing forms:** In the design of forms, it's very important to provide guidance before and after submitting the forms.

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Benefits of Good Design

- Several research were carried out to know the benefits of a well-designed screen
- A researcher attempted to design less crowded screen which improved the productivity of the users by 20%
- Following design principles for reformatting inquiry screens reduced decision making time by 40%



Benefits of Good Design

- Another study compared 500 screens used to extract information from displays of airline or lodging information, it reduced the time to extract information i.e., 128% faster for the best format
- Proper formatting of information on screens does have a significant positive effect on performance
- Home page of an organization was redesigned due to the users' complaints about locating the information. 73% of the searches were completed with an average completion time of 113 seconds after one redesign



Benefits of Good Design

- A study evaluated 4 websites used for online shopping. The task completion rate was found to be higher in the websites with better interface designs and hence good business
- A good screen design requires less training to the users which in turn reduces the training costs. Also, fewer assist calls are required which reduces the support line costs



A Brief History of Screen design



History of Human-Computer Interface

- A common mode of communication is using movements and gestures
- They are independent of language we use
- Another way of communication is using spoken language
- The parties who are communicating need to know a common language



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History of Human-Computer Interface

- Written language is the next level of communication
- Most of the people can speak but cannot write
- Hence, Spoken language is the efficient way of communicating with the people



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History of Human-Computer Interface

- Earlier, computers required input typed in a proper format through keyboard
- People started using the device with varying degrees of skills
- Slowly preferences such as Command Language, Q&A, Menu Selection, Function Key Selection, Forms came into use



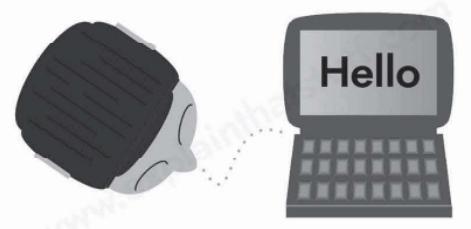
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History of Human-Computer Interface

- Today we have computers with speech and handwriting recognition features
- They still lack the universality and richness of typed input



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History of Screen Design

IBM introduced the first 3270 cathode ray tube text-based terminal. The 3270 was used in many ways in the offices and the need for a better design was being considered.



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1970's Screen Design:

- Cluttered screen with unintelligible captions
- The screens possessed a command field which the user had to remember what has to be keyed in
- Screens were monochromatic (green text and black background)

TDX95210	THE CAR RENTAL	10/11/76	10:25
NAM	TEL	RO	
PU	R	C	RT MP
Command ==>			

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1980's Screen Design:

- The screens were visually less cluttered, with concepts such as grouping and alignment of elements being developed
- The commands were listed on the screen
- Meaningful field captions were mentioned

THE CAR RENTAL COMPANY

RENTER >>	Name: _____
	Telephone: _____
LOCATION >>	Office: _____
	Pick-up Date: _____
	Return Date: _____
AUTOMOBILE>>	Class: _____
	Rate: _____
	Miles Per Day: _____

(PR, ST, FU, MD, CO, SC)

The maximum allowed miles per day is 150

Enter F1=Help F3=Exit F12=Cancel

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1990's and Beyond Screen Design:

- The screen designs evolved greatly by the use of graphics
- Borders were used to enhance groupings
- Buttons and menus were used.
- Multiple properties of elements like different font sizes, styles, line thickness, and colors were introduced

THE CAR RENTAL COMPANY

RENTER	Name: _____
	Telephone: _____
LOCATION	Office: _____
	Pick-up Date: _____
	Return Date: _____
AUTOMOBILE	Class: _____
	Rate: _____
	Miles Per Day: _____

OK Apply Cancel Help

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- Menu controls like list boxes, drop-down combination boxes, spin boxes etc. were used for entry fields

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UNIT 1

Introduction to HCI

The Graphical User Interface (GUI)

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Introduction to GUI

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Introduction

A user interacts with an application by providing some information to application which can be done in two ways

- The first is Character User Interface(CUI) where the user interacts with the application by typing some characters
- CUI is not user friendly as user has to type all the commands and also remember them
- Example: DOS

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The screenshot shows a terminal window titled "linuxhandbook.com presents" with the command line "yesik.it:~/EP24\$". The terminal displays the following sequence of commands:

```
yesik.it:~/EP24$ echo -ne 'tab:[\t] backspace:[\b]; \n> sleep 1; echo -ne '\b'; \n> sleep 1; echo -n ']'; \n> sleep 1; echo ''
```

The terminal window has a title bar "linuxhandbook.com presents" and a status bar at the bottom left showing "[EP24] 2:bash*" and a URL "https://yesik.it/EP24".

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Introduction

- The second way is Graphical User Interface(GUI) where the user interacts with the application through graphics
 - With the help of pointing devices, users use Graphics such as menus, icons, images, etc. also known as Objects
 - Desktop is an example of a GUI



Introduction

- The GUI objects convey information and represent actions that can be taken by the user
 - Examples: Windows XP, Windows 7, Linux mint etc.



Introduction

- GUI was first developed by Alan Kay, Douglas Engelbart, and a group of other researchers in 1981 at XEROX PARC
- Later, Apple introduced a GUI on its Computer called Lisa on January 19, 1983



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Introduction

- Users can also interact with a computer application through voice and gestures
- Smart assistants such as Alexa on Amazon devices, use voice control
- In Virtual reality games, users interact with 3D design environments through their body gestures or movements

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GUI Objects

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GUI Objects

Users interact in a GUI through a collection of elements called Objects

- Examples : Menu, icons, windows, buttons etc.
- Menu allows the user to execute the commands by selecting from a list of options
- Icon is a small image representing a file, a program or a webpage
- Window is used to display information on the screen
- Buttons allow users to execute commands after click of it

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GUI Objects

- The objects can be seen, touched, or heard
- The objects are always visible to the users and are used to perform tasks
- When the user interacts with the objects, they change color, size, or visibility
- Every object is an independent entity

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GUI Objects

- All objects have standard resulting behavior
- The operations or actions performed by the users on the objects are,
 - Accessing and modifying objects by pointing
 - Selecting
 - Manipulating

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Interaction Styles

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Introduction

- Interaction styles are methods used for communication between a user and a computer
- The User Interfaces (UI) evolved due to the different interaction styles which aided them
- There are many options for an interface designer to choose interaction styles while designing a graphical system, Web page or an application

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Introduction

- Some of the interaction styles are:
 - Command Line
 - Menu Selection
 - Form fill-in
 - Direct Manipulation
 - Anthropomorphic
- Type of the system being developed and the characteristics of I/O devices to be used define the choice of interaction styles

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Command Line

- User types the commands for a program

A screenshot of a terminal window titled "linuxhandbook.com presents". The window shows a command-line session where the user is creating a strikethrough effect using echo and newlines. The terminal window has a dark background and light-colored text. The bottom status bar shows "[EP24] 2:bash*" on the left and "https://yesik.it/EP24" on the right.

```
yesik.it:~/EP24$ while true; do
> echo -ne 'strikethrough\r'
> echo -ne '.....\r'
> done
-----through
```

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Command Line

Advantages:

- It is powerful and provides immediate access to the system functions
- Commands may include options or parameters to change their behaviour
- This mode conserves screen space

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Command Line

Disadvantages:

- User must learn and remember the commands
- The command lines can be cryptic and have complex syntax
- Typing errors can lead to user's frustration
- Text-only data representation

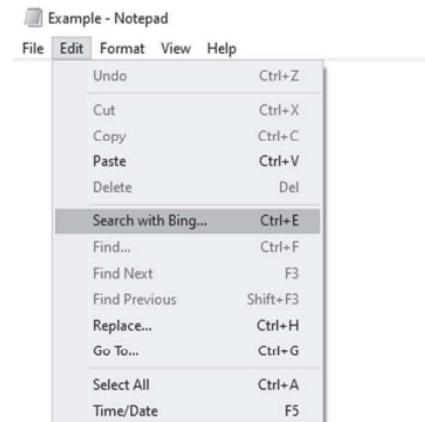
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Menu Selection

- Menu is a set of options displayed on the screen where the selection and execution of options results in state change of interface
- Options are chosen using pointing device or a keystroke



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Menu Selection

Advantages:

- Screen menus are better as they use a person's powers of recognition and not remembrance
- Menus break a complex interaction into small steps, which structure and aid the decision-making

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Menu Selection

Disadvantages:

- They are effective only when menu choice labels are meaningful and understandable
- Too many small steps slows the process of selection for a knowledgeable user



Form Fill-in

- A Form contains a screen with a series of controls and fields into which a user types or selects from options
- Examples of form controls are list boxes, drop-down boxes, buttons, text boxes etc.

Advantages:

- It simplifies information entry
- It requires minimal training



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Form Fill-in

Disadvantages:

- It consumes screen space
- Requires careful and efficient design
- It does not prevent typing error

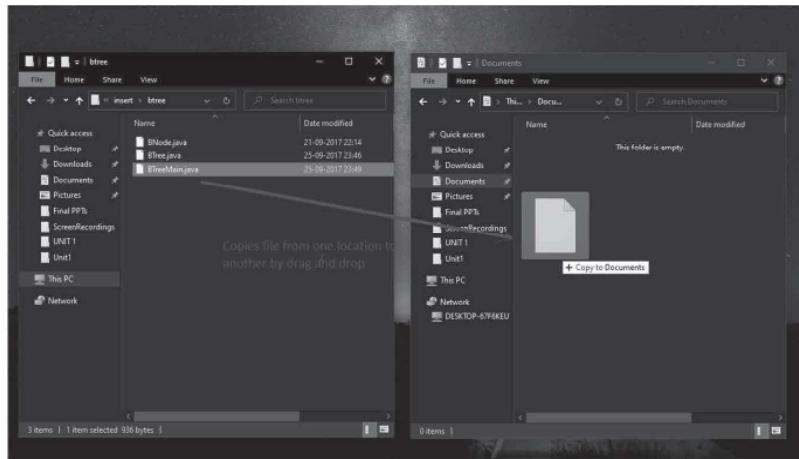
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Direct Manipulation

It allows user to directly act on a set of objects using manual actions whose effects will be displayed immediately on the screen



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Direct Manipulation

Advantages:

- Faster learning
- Easy to remember
- Exploits visual or spatial cues
- Easy error recovery
- Provides context and immediate feedback

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Direct Manipulation

Disadvantages:

- Greater design complexity
- Inefficient for touch typists
- Difficult for visually impaired
- Screen clutter may increase

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Anthropomorphic

- It tries to interact with people the same way people interact with each other
- It aims to design the interface with human-like qualities

Advantages:

- They are natural because these interfaces include spoken natural language dialogues, hand gestures, facial expressions and eye movements

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Anthropomorphic

Disadvantages:

- Development of these interfaces require understanding of human behavior
- Difficult to implement as designers need to understand the meaning of gestures and expressions

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Popularity of Graphics

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Popularity of Graphics

- The graphics became popular because of its three dimensional look with lot of graphical images called icons
- The icons on a GUI represent objects or actions
- Information floated in windows and raised above background plane
- The controls could be moved when activated
- Information could appear and disappear when needed

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Popularity of Graphics

- Text is replaced by icons
- Increased computer power and improved displays have enabled a system to react quickly, dynamically, and meaningfully
- The user's screen on a personal computer is also known as a Desktop

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Popularity of Graphics

- Desktop has a lot of user information or data stored in the form of objects representing notes, files, trays, and trash cans all scattered on the screens
- It is also called as a WIMP interface: windows, icons, menus and pointing devices

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Popularity of Graphics

Advantages of Graphics:

- Helped in enhancing person's information processing capabilities
- Reduced the requirement of perceptual and mental information recoding and reorganization, reducing the memory loads
- Helps in faster information transfer and gives a more compact representation of information

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Popularity of Graphics

- It adds an appeal to the interface
- It allows the user's to create a customized way of storing and organizing data

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The Concept of Direct Manipulation

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Introduction

Ben Shneiderman, a Professor of Computer Science at Maryland University, used the term “Direct Manipulation Systems” to describe graphical systems with direct manipulation style of interaction in 1982

- Direct Manipulation allows the users to directly act on a set of objects using rapid, reversible and incremental actions
- The results of the actions are displayed immediately on the screen

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Characteristics of Direct Manipulation Systems

- The system is designed to look like an extension of the real world:
 - User interacts with the screen which has objects or actions replicating his/her familiar environment
 - Focus of user is on data but not on the applications and tools
 - The physical organization of the system is hidden from the view



Characteristics of Direct Manipulation Systems

- Objects and actions are continuously visible:
 - Labelled buttons replace complex syntax and command names and hence actions performed need not be remembered
 - Objects are continuously visible
 - Cursor action and motion occur in physically obvious and intuitively natural ways



Characteristics of Direct Manipulation Systems

- Actions are fast, incremental and the results are displayed after every action:
 - The results of actions are immediately displayed visually on the screen in their new and current form
 - Auditory feedback may also be provided
- Incremental actions are easily reversible:
 - Any incorrect action, can be easily undone

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Graphical Systems

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Introduction

Graphical systems were developed with the following goals:

- To reduce the memory requirements imposed on the user
- To make effective use of the user's information-processing capabilities
- To reduce system learning requirements



Advantages of Graphical Systems

- Recognizing symbols is faster than text
- Faster adaptation to the system
- Errors can be rectified if the actions does not result in correct response
- Symbols are more effective in conveying simple instructions
- Graphical representations of objects are found to be more natural and closer to human capabilities



Advantages of Graphical Systems

- Graphical User interfaces are more attractive and appealing
- Graphical interfaces avoid language translations
- Typing skills are not required



Disadvantages of Graphical Systems

- Greater design complexity as designer need to choose the correct controls among various options available
- Users need more time to learn about meaning of icons and also using pointing device
- There are not enough experimentally-derived design guidelines for a developer
- Not all users prefer a pure iconic interface so it is not always a preferred style



Disadvantages of Graphical Systems

- The number of symbols and icons has to be restricted as there is limitation on human comprehension
- Hardware limitations may not result in a very efficient graphical system
- Screen clutter may increase which leads to confusion

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Characteristics of GUI

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Characteristics of GUI

- Sophisticated Visual Presentation:
 - Main objective of the GUI is to create a screen reflecting the real-world
 - A sophisticated graphical system includes drawings and icons, and also different styles and sizes of fonts
 - Millions of choices for colors are available

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Characteristics of GUI

- Graphics also allow animation, presentation of photographs and motion video
- The interface elements include windows, menus, icons to represent objects such as programs or files, assorted screen-based controls

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Characteristics of GUI

- Pick-and-Click interaction:
 - The user of a GUI identifies the element on a graphical screen and selects it for some function
 - Identifying an element is called pick and performing an action is called a click
 - Users can either use pointing devices such as mouse or input devices such as keyboard to point and select elements of screen

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Characteristics of GUI

- Restricted Set of Interface Options :
 - The number of alternatives available to the user is what is presented on the screen or what may be retrieved through what is presented on the screen
 - The concept is known as WYSIWYG (What You See Is What You Get)

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Characteristics of GUI

- **Visualization:**
 - Voluminous data or too abstract information is difficult to understand
 - Such information can be made understood easily by a cognitive process called Visualization
 - An entity's representation is changed to gradually reveal the structure and/or function of the underlying system

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Characteristics of GUI

- Presenting specialized graphic pictures facilitates visualization
- The main aim is to reproduce graphical image that convey the most relevant information to the user

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Characteristics of GUI

- Object Orientation:

- A graphical system is made up of objects and actions
- A well-designed system helps the users focus on the objects and not on the actions to be carried out on them
- Objects can contain sub-objects
- Objects can be divided into three classes: data, container, and device

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Characteristics of GUI

Data Objects:

- These objects present information in the form of either text or graphics
- They appear in the body of the screen
- These are the screen-based controls used for presentation or collection of information

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Characteristics of GUI

Container Objects:

- These are the objects that hold other objects
- They can be used to group two or more related objects
- Container objects are of three types: workplace, folders and work area
- Workplace is the desktop, a storage area for all the other objects

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Characteristics of GUI

- Folders are general-purpose containers for the long-term storage of objects
- Work areas are temporary storage folders used for storing multiple objects currently being worked on

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Characteristics of GUI

Device Objects:

- They represent physical objects in the real world, such as printers or trash cans
- These objects may contain other objects to act upon
- Example: A file in a printer for printing



Properties of Objects

- Properties are the unique characteristics of an object which help to describe them and can be changed by users
- Examples: Text styles, font size, window background colors etc.



Actions

- They are used to manipulate the objects in specific ways
- Users take actions on objects in two ways:
 - Manipulate objects by giving specific commands
 - Actions through commands can be performed using direct manipulation or command buttons
 - Examples: Open a document, print a document, close a window etc.

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Actions

- Modify the properties or attributes of the objects
 - When objects are selected for modifying their properties or attributes, the selection will remain in effect until they are deselected
 - Examples: Selecting a cascaded windows to be displayed, a particular font style etc.

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Characteristics of GUI

- **Use of Recognition Memory:**

As the objects and actions are continuously visible in the current graphical systems, the user recognizes and remembers them.

- **Concurrent Performance of Functions:**

- Graphic systems may perform more than one task at a time
- Multiple programs will run simultaneously to perform these tasks and is known as multitasking



Characteristics of GUI

- Data can be transferred between programs or stored temporarily on a clipboard for later transfer
- There are two ways of multitasking:
 - Cooperative multitasking: If a system is not busy on a primary task, it can process a background task
It is also known as non-preemptive multitasking



Characteristics of GUI

- Preemptive multitasking: The applications are running as separate tasks and the processing power is divided into time slices and are allocated to each application

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Name	Title	Author	Source	License
CUI	Format Text in Linux Terminal with Fold and FMT commands	Sylvain Leroux	https://linuxhandbook.com/fold-fmt-commands/	CC BY-SA 4.0
GUI	Gnome shell with an updated appearance	Athenkosi Hlubi	https://commons.wikimedia.org/wiki/File:GNOME_3.32.1.png	CC BY-SA 4.0
Form fill-in	Registration form of PHP-based E-Commerce Web-Shop-Software ZenCart	User 'it-software' at slideshine.de	https://commons.wikimedia.org/wiki/File:Zen-cart_Web-Shop_Frontend_Registration_Form.png	CC BY-SA 2.0
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UNIT 1

Introduction to HCI

The Web User Interface

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Introduction to Web Interface

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Definition – Web Interface

- World Wide Web (WWW) was developed initially to act as a communication medium for researchers and scientists
- The important design considerations of the Web are the amount of information available and its convenient access
- In order to access the web applications, an interface is required and it is known as Web Interface
- The focus of Web interface design is mainly on navigation and presentation of information

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Web Page Design

- The main goal is to provide information
- It is designed to build a hierarchy of menus and pages
- The pages are well structured, easy to use, natural and truthful
- The design should properly balance the structure and relationships of menus, content, and other linked documents or graphics
- The design should create an environment where people can navigate and move easily between pages of information

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Web Application Design

- The main goal is to collect and process data
- It is designed for a user to do and save something
- Application pages are spread across the screen
- The pages seek the user's attention for a longer period of time
- Applications may be up and running continuously



Complexity in Web Interface Design

- The design language is HTML and intended users were expected to be technically skilled
- HTML has limited objects and interaction styles and could not provide a platform to present the information in an effective way
- Browser navigation through the “Back” and “Forward” buttons or links can take time
- The main concern is about information architecture and task flow which cannot be standardized easily



Popularity of the Web

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Introduction - The Web

- The graphical user interface revolutionized the user interface whereas the Web revolutionized computing
- The World Wide Web is also referred to as WWW, W3, or the Web
- The Web is an interconnected system of public web pages accessible through the Internet
- Web helps people scattered across the globe to communicate, access information, publish, and be heard

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Introduction - The Web

- The Web enables people to control the display and the rendering of Web pages
- It also allow the users to perform following actions:
 - change the typography and colors
 - turn off graphics
 - decide whether or not to transmit certain data over non-secure channels
 - accept or refuse cookies

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Popularity of the Web

- The number of Internet hosts has increased since 1984 i.e, from 1000 to 1 million in 1992
- Commercialization of Internet has increased the growth rate
- With 10 million hosts online, 40 million people got connected in 1996
- In 2005, the number of Internet hosts exceeded 350 million and the number of users were one billion

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Characteristics of Web Interface

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GUI versus Web Page design

Parameters	GUI	Web Design
Devices	<ul style="list-style-type: none">Limited hardware variationsWell defined hardware characteristicsScreen appears same as specified	<ul style="list-style-type: none">Enormous hardware variationsScreen appearance get affected by hardware
User Focus	<ul style="list-style-type: none">Data and applications	<ul style="list-style-type: none">Navigation and information
Data/Information	<ul style="list-style-type: none">Properties of data are known and used by trusted sourcesData is organised in a meaningful way and presented to the system by known users and organisationsData can be private or shared	<ul style="list-style-type: none">Data is unknown and created by unknown and untrusted usersUnorganised data and is placed onto the web by known users and organisationsData is not private

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GUI versus Web Page design

Parameters	GUI	Web Design
Navigation	<ul style="list-style-type: none"> Using components such as menus, lists, dialogs and wizards Design is standardized by toolkits and style guides 	<ul style="list-style-type: none"> Using components such as links, bookmarks, types URLs Not many design standards are available
Response time	<ul style="list-style-type: none"> Nearly instantaneous 	<ul style="list-style-type: none"> It is variable and depends on parameters such as transmission speed, page content etc.
System Capability	<ul style="list-style-type: none"> Depends on software and hardware capabilities 	<ul style="list-style-type: none"> Limited and depends on capabilities of hardware, browser, software, client support etc.



GUI versus Web Page design

Parameters	GUI	Web Design
Integration	<ul style="list-style-type: none"> To support seamless integration of all applications, standard tools and components are used 	<ul style="list-style-type: none"> Individual sites have some basic functionalities such as navigation, printing with toolkits etc. Each site is considered as a separate entity
Security	<ul style="list-style-type: none"> Not implemented for PC users For other users, security is provided based on user's requirement, investment and efforts 	<ul style="list-style-type: none"> Security options are provided by the browser and if used, will limit the functionalities
Reliability	<ul style="list-style-type: none"> Tightly controlled in case of business systems 	<ul style="list-style-type: none"> May be affected due to the disruptions caused by user, telephone line, ISP, hosting servers etc.



Printed Page versus Web Pages

Parameters	Printed Page	Web Page
Page Size	<ul style="list-style-type: none"> Large and fixed size Designed as a single entity and visual impact is maintained in a hard-copy form 	<ul style="list-style-type: none"> Presented in pieces and size depends on browser technology and monitor size Designed as a single entity but visual impact gets degraded as they are presented in pieces Requires scrolling to get full view
Page rendering	<ul style="list-style-type: none"> Rendering is immediate as they are presented as a single entity to users 	<ul style="list-style-type: none"> Slow rendering and depends on transmission speed and content
Page layout	<ul style="list-style-type: none"> Very precise 	<ul style="list-style-type: none"> Depends on design toolkits, user browser characteristics and screen size
Page resolution	<ul style="list-style-type: none"> Better 	<ul style="list-style-type: none"> Comparatively less

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Printed Page versus Web Pages

Parameters	Printed Page	Web Page
User Focus	<ul style="list-style-type: none"> Information is presented as one entity irrespective of page size 	<ul style="list-style-type: none"> Information is presented as snapshot and page's length and depth is unknown
Page navigation	<ul style="list-style-type: none"> It is simple and turning of pages is a motor skill learned early in life 	<ul style="list-style-type: none"> It is done through clicking on links that have to be followed after making some decisions
Interactivity	<ul style="list-style-type: none"> Happens by the user's eyes selectively traversing the static information on a page and understanding 	<ul style="list-style-type: none"> Happens through eyes and hands used to scroll, point, expand and click on the required information
Page Independence	<ul style="list-style-type: none"> Pages are organized sequentially in a standardized way 	<ul style="list-style-type: none"> Pages here can be viewed randomly and each page is independent of each other w.r.t the content

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Principle of UI design

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Principles of UI Design

- A good interface acts as an extension of a person, reflecting his/her personality
- It should be useful and respond to his or her specific needs
- Also, it should help the users to accomplish the business objectives for which it is built in a very effective and efficient way
- It should be easy to learn and fun to use
- Interface should act as both connector and a separator

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General Principles

- Many researchers have defined certain fundamental principles to design and implement effective GUI and Web interfaces

Accessibility:

- It refers to a property that makes the design to be usable by everyone without any modification
- There are four properties of an accessible design i.e., **Perceptibility, Operability, Simplicity, Forgiveness**

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General Principles

Aesthetically Pleasing: An interface looks visually appealing if,

- A meaningful contrast is provided between screen elements
- Groupings are created
- Screen elements and groups are aligned
- A three-dimensional representation is provided
- Color and graphics are effectively utilized

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General Principles

Availability: It refers to a feature where all the aspects of the system should be made available all the time without the use of modes and states.

Clarity: All the visual elements, functions, metaphors, words and text should be very clear visually, conceptually, and linguistically

Compatibility: It helps in providing compatibility with the user, task and job, and the product.



General Principles

Configurability: This allows easy personalization, configuration, and reconfiguration of settings so that the interface can be easily changeable according to the user's needs.

Consistency: In a consistent system, all similar components should have the following:

- Similar look
- Similar uses
- Operate similarly

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General Principles

Control: It deals with the control that the user has over the interface.

- User alone should initiate actions through requests
- Actions should be performed quickly and they should be capable of interruption or termination
- The user should not be interrupted during errors
- The interface should be designed considering the user's skills, experiences, habits, and preferences

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General Principles

Directness: The tasks should be performed using direct ways and any alternative methods should be made visible. The effect of actions should also be visible.

Efficiency: The control actions should need minimum eye and hand movements. Also, the navigation paths should be as short as possible.

Familiarity: The interaction design should use concepts and languages that are familiar to the user



General Principles

Flexibility: This principle refers to designing an interface considering the changing needs of its users. Further, the performance can be based upon,

- User's knowledge and skills
- User's experience
- User's personal preference
- User's habits



General Principles

Forgiveness: This refers to the acceptance of mistakes done by users and recovering from them. The design should be,

- Tolerate and forgive human errors
- Help in preventing errors from occurring whenever possible
- Also, provide protection against errors
- Provide constructive messages when an error occurs



General Principles

Predictability: This principle helps in anticipating the progression of a task. The design should consider the following features:

- Every action or operation should result in an expected output and also give a clue about the next operation
- The screen elements should be distinct and recognizable
- More than one action should not be combined



General Principles

Recovery: This principle helps in reversing and recovering from a wrong action. Following features need to be considered:

- Commands or actions can be canceled or reversed
- In the case of difficulty, users can return to a certain point from where they can retry
- Due to errors, a user should never lose his work. The errors could be due to hardware, software, or communication problems



General Principles

Responsiveness: This principle helps in providing immediate acknowledgment for all user actions which can improve performance and instill confidence.

- It should rapidly respond to the user's requests in the form of a textual message, a visual, or an auditory response

Transparency: This design principle allows the users to focus on the task or job and not on the mechanics of the interface.



General Principles

Simplicity: It helps in presenting a simple interface to the users.

Following features should be considered:

- The system should hide functions until needed and disclose them progressively
- It should present common and necessary functions first and hide more sophisticated and less frequently used
- It should provide uniformity and consistency and eliminate unnecessary elements



General Principles

Trade-Offs: It gives trade-offs between the user requirements and the technical requirements for an interface design.

- From the designer's perspective, the design trade-offs can be w.r.t accuracy, time, cost and ease of use
- A proper understanding of the user and his requirements can help in making correct decisions

