**UNIT-1**

**HUMAN COMPUTER INTERACTION**

**Introduction**

Human–computer interaction (HCI), alternatively man–machine interaction (MMI) or computer– human interaction (CHI) is the study of interaction between people (users) and computers. With today's technology and tools, and our motivation to create really effective and usable interfaces and screens, why do we continue to produce systems that are inefficient and confusing or, at worst, just plain unusable? Is it because:

* We don't care?
* We don't possess common sense?
* We don't have the time?
* We still don't know what really makes good design?

**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."

**Goals:**

1 .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.

2. 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

**Defining the User Interface:**

User interface, design is a subset of a field of study called human-computer interaction (HCI). Human-computer interaction is the study, planning, and design of how people and computers work together so that a person's needs are satisfied in the most effective way.

HCI designers must consider a variety of factors: What people want and expect, physical limitations and abilities people possess, How information processing systems work, What people find enjoyable and attractive. Technical characteristics and limitations of the computer hardware and software must also be considered.

The user interface is the part of a computer and its software that people can see, hear, touch, talk to, or otherwise understand or direct. The user interface has essentially two components: input and output.

Input is how a person communicates his / her needs to the computer. Some common input components are the keyboard, mouse, trackball, one's finger, and one's voice.

Output is how the computer conveys the results of its computations and requirements to the user.

Today, the most common computer output mechanism is the display screen, followed by mechanisms that take advantage of a person's auditory capabilities: voice and sound.

The use of the human senses of smell and touch output in interface design still remain largely unexplored.

Proper interface design will provide a mix of well-designed input and output mechanisms that satisfy the user's needs, capabilities, and limitations in the most effective way possible.

The best interface is one that it not noticed, one that permits the user to focus on the information and task at hand, not the mechanisms used to present the in-formation and perform the task.

**Importance of good design**

With today's technology and tools, and our motivation to create really effective and us-able interfaces and screens, why do we continue to produce systems that are inefficient and confusing or, at worst, just plain unusable? Is it because:

* We don't care?
* We don't possess common sense?
* We don't have the time?
* We still don't know what really makes good design?
* But we never seem to have time to find out what makes good de-sign, nor to properly apply it.

After all, many of us have other things to do in addition to designing interfaces and screens. So we take our best shot given the workload and time constraints imposed upon us.

The result, too often, is woefully inadequate. Interface and screen design were really a matter of common sense, we developers would have been producing almost identical screens for representing the real world.

**Brief history of Screen Design.**

While developers have been designing screens since a cathode ray tube display was first attached to a computer, more widespread interest in the application of good design principles to screens did not begin to emerge until the early 1970s, when IBM in-troduced its 3270 cathode ray tube text-based terminal.

A 1970s screen often resembled the one pictured in. It usually consisted of many fields (more than are illustrated here) with very cryptic and often unintelligible captions.

It was visually cluttered, and often possessed a command field that challenged the user to remember what had to be keyed into it.

Ambiguous messages often required referral to a manual to interpret. Effectively using this kind of screen required a great deal of practice and patience.

Most early screens were mono-chromatic, typically presenting green text on black backgrounds

**Graphical User Interface**

**Introduction**

The Xerox systems, Altus and STAR, introduced the mouse and pointing and selecting as the primary human-computer communication method.

The user simply pointed at the screen, using the mouse as an intermediary.

These systems also introduced the graphical user interface as we know it a new concept was born, revolutionizing the human-computer interface.

**Popularity of graphics**

* A graphical screen bore scant resemblance to its earlier text-based colleagues.
* Older text-based screen possessed a one dimensional graphic screens assumed a three-dimensional look.
* Controls appeared to rise above the screen and move when activated. Information could appear, and disappear, as needed.
* Text could be replaced by graphical images called icons.
* These icons could represent objects or actions Selection fields such as radio but-tons, check boxes, list boxes, and palettes coexisted with the reliable old text entry field.
* More sophisticated text entry fields with attached or drop-down menus of. Objects and actions were selected through use of pointing mechanisms.
* Increased computer power. User's actions to be reacted to quickly, dynamically, and meaningfully.
* WIMP interface: windows, icons, menus, and pointers.
* Graphic presentation is much more effective than other presentation methods. Properly used, it reduces the requirement for perceptual and mental information recoding and reorganization, and also reduces the memory loads.
* It permits faster information trans-fer between computers and people by permitting more visual comparisons of amounts, trends, or relationships; more compact representation of information
* Graphics also can add appeal or charm to the inter-face and permit greater customization to create a unique corporate or organization style.

**The concept of direct manipulation**

**The system is portrayed as an extension of the real world:**

* It is assumed that a per-son is already familiar with the objects and actions in his or her environment of interest.
* The system simply replicates them and portrays them on a different medium, the screen.
* A person has the power to access and modify these objects, among which are windows.
* A person is allowed to work in a familiar environment and in a familiar way, focusing on the data, not the application and tools.
* The physical organization of the system, which most often is unfamiliar, is hidden from view and is not a distraction.

**Continuous visibility of objects and actions**:

Like one's desktop, objects are continuously visible. Reminders of actions to be performed are also obvious, labeled buttons replacing complex syntax and command names.

Cursor action and motion occurs in physically obvious and natural ways. One problem in direct manipulation, however, is that there is no direct anal-ogy on the desk for all necessary windowing operations.

A piece of paper on one's desk maintains a constant size, never shrinking or growing. Windows can do both. Solving this problem required embedding a control panel, a familiar concept to most people, in a window's border. This control panel is manipulated, not the window itself.

Actions are rapid and incremental with visible display of results; the results of actions are immediately displayed visually on the screen in their new and current form.

Auditory feedback may also be provided. The impact of a previous action is quickly seen, and the evolution of tasks is continuous and effortless.

**Direct Manipulation Systems**:

The concept of direct manipulation actually preceded the first graphical system. The earliest full screen text editor’s possessed similar character-is tics.

Screens of text resembling a piece of paper on one's desk could be created (ex-tension of real world) and then reviewed in their entirety (continuous visibility).

Editing or restructuring could be easily accomplished (through rapid incremental ac-tions) and the results immediately seen.

Actions could be reversed when necessary. It took the advent of graphical systems to crystallize the direct manipulation concept, however.

**Indirect Manipulation**: In practice, direct manipulation of all screen objects and actions may not be feasible because of the following

The operation may be difficult to conceptualize in the graphical system. The graphics capability of the system may be limited. The amount of space available for placing manipulation controls in the window border may be limited. When this occurs, indirect manipulation is provided.

Indirect manipulation substitutes words and text, such as pull-down or pop-up menus, for symbols, and substitutes typing for pointing. Most window systems are a combination of both direct and indirect manipulation.

A menu may be accessed by pointing at a menu icon and then se-letting it (direct manipulation). The menu itself, however, is a textual list of operations (indirect manipulation). When an operation is selected from the list, by pointing or typing, the system executes it as a command.

Which style of interaction-direct manipulation, indirect manipulation, or a combi-nation of both-is best, under what conditions and for whom, remains a question whose answer still eludes us.

**GRAPHICAL SYSTEMS**

* Reduce the memory requirements.
* More effective use of one's information dramatically reduce system learning requirements.
* Experience indicates that for many people they have done all these things.

**Advantages** :

* Symbols recognized faster than text
* Faster learning
* Faster use and problem solving
* Easier remembering
* More natural
* Exploits visual/spatial cues
* Fosters more concrete thinking
* Provides context
* Fewer errors
* Increased feeling of control
* Immediate feedback
* Predictable system responses
* Easily reversible actions
* Less anxiety concerning use
* More attractive
* May consume less space
* Replaces national languages
* Easily augmented with text displays
* Smooth transition from command language system

**Disadvantages:**

* Greater design complexity Learning still necessary
* Replaces national languages Easily augmented with text displays
* Smooth transition from command language system
* Lack of experimentally-
* derived design guidelines use a pointing device may also have to be learned
* Working domain is the present
* Human comprehension limitations
* Window manipulation requirements
* Production limitations
* Few tested icons exist
* Inefficient for touch typists
* Inefficient for expert users
* Not always the preferred style of interaction
* Not always fastest style of interaction
* Increased chances of clutter and confusion
* May consume more screen space
* Hardware limitations

**Characteristics of the Graphical User Interface:** A graphical system possesses a set of defining concepts. Included are sophisticated visual presentation, pick-and-click interaction, a restricted set of

interface options, visualization, object orientation, extensive use of a person's recognition memory, and concurrent performance of functions.

**Sophisticated Visual Presentation:**

Visual presentation is the visual aspect of the interface. It is what people see on the screen. The sophistication of a graphical system permits displaying lines, including drawings and icons. It also permits the displaying of a variety of character fonts, including different sizes and styles. The display of 16 million or more colors is possible on some screens. Graphics also permit animation and the presentation of photograph and motion video. The meaningful interface elements visually presented to the user in a graphical System include, windows (primary, secondary, or dialog boxes), menus (menu bar, pull down, pop-up, cascading), icons to represent objects such as programs or files, assorted screen-based controls (text boxes, list boxes, combination boxes, settings, scroll bar and buttons), and a mouse pointer and cursor.

**pick-and-click**

The primary mechanism for performing this pick-and-click is most often the mouse and its buttons. The user moves the mouse pointer to the relevant element (pick) and the action is signaled (click). Pointing allows rapid selection and feedback. The hand and mind seem to work smoothly and efficiently together. The secondary mechanism for performing these selection actions is the keyboard most systems permit pick-and-click to be performed using the keyboard as well.

**Visualization:**

Visualization is a cognitive process that allows people to understand. Information that is difficult to perceive, because it is either too voluminous or too abstract Presenting specialized graphic portrayals facilitates visualization. The best visualization method for an activity depends on what People are trying to learn from the data. The goal is not necessarily to reproduce a really graphical image, but to produce one that conveys the most relevant information. Effective visualizations can facilitate mental insights, increase productivity, and for faster and more accurate use of data.

**Object Orientation:**

A graphical system consists of objects and actions. Objects are what people see on screen. They are manipulated as a single unit. Objects can be composed of sub objects. For example, an object may be a document. The document's sub objects may be a paragraph, sentence, word, and letter.

A collection is the simplest relationship-the objects sharing a common aspect. A collection might be the result of a query or a multiple selection of objects. Operations can be applied to a collection of objects. A constraint is a stronger object relationship.

Changing an object in a set affects some other object in the set. A document being organized into pages is an example of a constraint.

A composite exists when the relationship between objects becomes so significant that the aggregation itself can be identified as an object. Examples include a range of cells organized into a spreadsheet, or a collection of words organized46 into a paragraph.

A container is an object in which other objects exist. Examples include text in a document or documents in a folder. A container often influences the behavior of its con-tent. It may add or suppress certain properties or operations of objects placed within it, control access to its content, or control access to kinds of objects it will accept. These relationships help define an object's type. Similar traits and behaviors exist in objects of the same object type.

Another important object characteristic is persistence. Persistence is the maintenance of a state once it is established. An object's state (for example, window size, cursor location, scroll position, and so on) should always be automatically preserved when the user changes it.

**Concurrent Performance of Functions**:

Graphic systems may do two or more things at one time. Multiple programs may run simultaneously. When a system is not busy on a primary task, it may process back-ground tasks (cooperative multitasking).

When applications are running as truly separate tasks, the system may divide the processing power into time slices and allocate portions to each application.

Data may also be transferred between programs. It may be temporarily stored on a "clipboard" for later transfer or be automatically swapped between programs.

**The Web User Interface**

Web interface design is essentially the design of navigation and the presentation of information. It is about content, not data. Proper interface design is largely a matter of properly balancing the structure and relationships of menus, content, and other linked documents or graphics. The design goal is to build a hierarchy of menus and pages that feels natural, is well structured, is easy to use, and is truthful. The

Web is a navigation environment where people move between pages of information, not an application environment. It is also a graphically rich environment. Web interface design is difficult for a number of reasons. First, its underlying design language, HTML, was never intended for creating screens to be used by the general population. Its scope of users was expected to be technical.

HTML was limited in objects and interaction styles and did not provide a means for presenting information in the most effective way for people. Next, browser navigation retreated to the pre-GUI era. This era was characterized by a "command" field whose contents had to be learned, and a navigational organization and structure that lay hidden beneath a mostly dark and blank screen

**The Popularity of the Web:**

While the introduction of the graphical user interface revolutionized the user interface, the Web has revolutionized computing. It allows millions of people scattered across the globe to communicate, access information, publish, and be heard.

It allows people to control much of the display and the rendering of Web pages. Aspects such as typography and colors can be changed, graphics turned off, and decisions made whether or not to transmit certain data over non secure channels or whether to accept or refuse cookies. Web usage has reflected this popularity.

The number of Internet hosts has risen dramatically: In 1984, hosts online exceeded 1,000; in 1987, 10,000; in 1989, 100,000, in 1990, 300,000; in 1992 hosts exceeded one million. Commercialization of the Internet saw even greater expansion of the growth rate.

In 1993, Internet traffic was expanding at a 341,634 percent annual growth rate. In 1996, there were nearly 10 million hosts online and 40 million connected people (PBS Timeline). User control has had some decided disadvantages for some Web site owners as well. Users have become much more discerning about good design.

Slow download times, confusing navigation, confusing page organization, disturbing animation, or other un-desirable site features often results in user abandonment of the site for others with a more agreeable interface. People are quick to vote with their mouse, and these warnings should not go unheeded.

**PRINCIPLES OF USER INTERFACE DESIGN:**

An interface must really be just an extension of a person. This means that the system and its software must reflect a person's capabilities and respond to his or her specific needs.

It should be useful, accomplishing some business objectives faster and more efficiently than the previously used method or tool did. It must also be easy to learn, for people want to do, not learn to do.

Finally, the system must be easy and fun to use, evoking a sense of pleasure and accomplishment not tedium and frustration. The interface itself should serve as both a connector and a separator:

A connector in that it ties the user to the power of the computer, and a separator in that it minimizes the possibility of the participants damaging one another. While the damage the user inflicts on the computer tends to be physical (a frustrated pounding of the keyboard), the damage caused by the computer is more psychological.

Throughout the history of the human-computer interface, various researchers and writers have attempted to define a set of general principles of interface design. What follows is a compilation of these principles.

They reflect not only what we know today, but also what we think we know today. Many are based on research, others on the collective thinking of behaviorists working with user interfaces.

These principles will continue to evolve, expand, and be refined as our experience with Gills and the Web increases

**General Principles:**

The design goals in creating a user interface are described below.

They are fundamental to the design and implementation of all effective interfaces, GUI and Web. These principles are general characteristics of the interface, and they apply to all aspects.

The compilation is presented alphabetically, and the ordering is not intended to imply degree of importance.

**Aesthetically Pleasing**:

* Provide visual appeal by following these presentation and graphic design principles:
* Provide meaningful contrast between screen elements.
* Create groupings.
* Align screen elements and groups.
* Provide three-dimensional representation.
* Use color and graphics effectively and simply.

**Clarity:**

* The interface should be visually, conceptually, and linguistically clear, including Visual elements Functions
* Metaphors
* Words and Text

**Compatibility:**

* Provide compatibility with the following:
* The user
* The task and job
* The Product
* Adopt the User’s Perspective

**Configurability**

* Permit easy personalization, configuration, and reconfiguration of settings.
* Enhances a sense of control
* Encourages an active role in understanding

**Comprehensibility:**

* A system should be easily learned and understood:
* A user should know the following: What to look at What to do When to do it Where to do it Why to do it How to do it
* The flow of actions, responses, visual presentations, and information should be in a sensible order that is easy to recollect and place in context.

**Consistency:**

* A system should look, act, and operate the same throughout.
* Similar components should: Have a similar look.
* Have similar uses.
* Operate similarly.
* The same action should always yield the same result
* The function of elements should not change.
* The position of standard elements should not change.

**Control**:

* The user must control the interaction.
* Actions should result from explicit user requests.
* Actions should be performed quickly.
* Actions should be capable of interruption or termination.
* The user should never be interrupted for errors
* The context maintained must be from the perspective of the user.
* The means to achieve goals should be flexible and compatible with the user's skills, experiences, habits, and preferences

**Directness:**

* Provide direct ways to accomplish tasks.
* Available alternatives should be visible.
* The effect of actions on objects should be visible

**Flexibility:**

* A system must be sensitive to the differing needs of its users, enabling a level and type of performance based upon: Each user's knowledge and skills.
* Each user's experience.
* Each user's personal preference.
* Each user's habits.
* The conditions at that moment

**Efficiency:**

* Minimize eye and hand movements, and other control actions.
* Transitions between various system controls should flow easily and freely.
* Navigation paths should be as short as possible.
* Eye movement through a screen should be obvious and sequential.
* Anticipate the user's wants and needs whenever possible.

**Familiarity:**

* Employ familiar concepts and use a language that is familiar to the user.
* Keep the interface natural, mimicking the user's behavior patterns.
* Use real-world metaphors.

**Forgiveness**:

* Tolerate and forgive common and unavoidable human errors.
* Prevent errors from occurring whenever possible.
* Protect against possible catastrophic errors.
* When an error does occur, provide constructive messages.

**Predictability:**

* The user should be able to anticipate the natural progression of each task. Provide distinct and recognizable screen elements.
* Provide clues to the result of an action to be performed.
* All expectations should be fulfilled uniformly and completely.

**Recovery:**

A system should permit: Commands or actions to be abolished or reversed. Immediate return to a certain point if difficulties arise. Ensure that users never lose their work as a result of: An error on their part. Hardware, software, or communication problems

**Responsiveness**:

* The system must rapidly respond to the user's requests.
* Provide immediate acknowledgment for all user actions:
* Visual.
* Textual Auditory.

.**Transparency**:

* Permit the user to focus on the task or job, without concern for the mechanics of the interface.
* Workings and reminders of workings inside the computer should be invisible to the user.

**Simplicity:**

* Provide as simple an interface as possible. Five ways to provide simplicity:
* Use progressive disclosure, hiding things until they are needed Present common and necessary functions first prominently feature important functions Hide more sophisticated and less frequently used functions.
* Provide defaults.

**UNIT -2**

**DESIGN PROCESS**

**Human interaction with computers**

* Understanding How People Interact with Computers
* Characteristics of computer systems, past and present, that have caused, and are causing, people problems.
* We will then look at the effect these problems have
* Why people have trouble with computers
* Responses to poor design
* People and their tasks

**Why People Have Trouble with Computers**

* Extensive technical knowledge but little behavioral training
* With its extensive graphical capabilities.
* Poorly designed interfaces.
* What makes a system difficult to use in the eyes of its user?
* Use of jargon
* Non-obvious design
* Fine distinctions
* Disparity in problem-solving strategies an "error-preventing" strategy
* Design inconsistency

**Psychological**

Typical psychological responses to poor design are:

**Confusion:**

* Detail overwhelms the perceived structure.
* Meaningful patterns are difficult to ascertain, and the conceptual model or underlying framework cannot be understood or established.

**Annoyance:**

* Roadblocks that prevent a task being completed, or a need from being satisfied, promptly and efficiently lead to annoyance.
* Inconsistencies in design, slow computer reaction times, difficulties in quickly finding information, out-dated information, and visual screen distractions are a few of the many things that may annoy users.

**Frustration:**

* An overabundance of annoyances, an inability to easily convey one's intentions to the computer, or an inability to finish a task or satisfy a need can cause frustration.
* Frustration is heightened if an unexpected computer response cannot be undone or if what really took place cannot be determined: Inflexible and un-forgiving systems are a major source of frustration.

**Panic or stress:**

* Unexpectedly long delays during times of severe or unusual pres-sure may introduce panic or stress.
* Some typical causes are unavailable systems or long response times when the user is operating under a deadline or dealing with an irate customer.

**Boredom:**

Boredom results from improper computer pacing (slow response times or long download times) or overly simplistic jobs.

**Abandonment of the system:**

* The system is rejected and other information sources are relied upon. These sources must, of course, be available and the user must have the discretion to perform the rejection.
* In business systems this is a common reaction of managerial and professional personnel. With the Web, almost all users can exercise this option.

**Partial use of the system:**

* Only a portion of the system's capabilities are used, usually those operations that are easiest to perform or that provide the most benefits. Historically, this has been the most common user reaction to most computer systems.
* Many aspects of many systems often go unused. Indirect use of the system: An intermediary is placed between the would-be user and the computer. Again, since this requires high status and discretion, it is another typical response of managers or others with authority.

**Modification of the task:** The task is changed to match the capabilities of the system. This is a prevalent reaction when the tools are rigid and the problem is unstructured, as in scientific problem solving.

**Compensatory activity:** Additional actions are performed to compensate for system inadequacies. A common example is the manual reformatting of information to match the structure required by the computer. This is a reaction common to workers whose discretion is limited, such as clerical personnel.

**Misuse of the system:** The rules are bent to shortcut operational difficulties. This requires significant knowledge of the system and may affect system integrity.

**Direct programming:**

The system is reprogrammed by its user to meet specific needs. This is a typical response of the sophisticated worker. These physical responses also greatly diminish user efficiency and effectiveness. They force the user to rely upon other information sources, to fail to use a system's complete capabilities, or to perform time-consuming "work-around" actions.

**Importance of human characteristics**

Importance in design is

* perception,
* memory,
* visual acuity,
* foveal and peripheral vision,
* sensory storage,
* information processing,
* learning, skill, and
* Individual differences.

**Perception**

* Proximity
* Similarity
* Matching patterns
* Succinctness
* Closure
* Unity
* Continuity
* Balance
* Expectancies
* Context

**Memory:**

Memory is not the most stable of human attributes, as anyone who has forgotten why they walked into a room, or forgotten a very important birthday, can attest.

* Short-term, or working, memory.
* Long-term memory
* Mighty memory
* Sensory Storage

**Mental Models**:

* As a result of our experiences and culture, we develop mental models of things and people we interact with.
* A mental model is simply an internal representation of a person's current understanding of something. Usually a person cannot describe this mental mode and most often is unaware it even exists. Mental models are gradually developed in order to understand something, explain things, make decisions, do something, or interact with another person.
* Mental models also enable a person to predict the actions necessary to do things if the action has been forgotten or has not yet been encountered.

**Movement Control** :

Once data has been perceived and an appropriate action decided upon, a response must be made; in many cases the response is a movement. In computer systems, movements include such activities as pressing keyboard keys, moving the screen pointer by pushing a mouse or rotating a trackball, or clicking a mouse button

The implications in screen design are: – Provide large objects for important functions. – Take advantage of the "pinning" actions of the sides, top, bottom, and corners of the screen.

**Learning:**

Learning, as has been said, is the process of encoding in long-term memory information that is contained in short-term memory. It is a complex process requiring some effort on our part. Our ability to learn is important-it clearly differentiates people from machines. Given enough time people can improve the performance in almost any task. Too often, however, designers use our learning ability as an excuse to justify complex design. A design developed to minimize human learning time can greatly accelerate human performance. People prefer to stick with what they know, and they prefer to jump in and get started. Unproductive time spent learning is something frequently avoided.

**Skill:**

* The goal of human performance is to perform skillfully. To do so requires linking in-puts and responses into a sequence of action. The essence of skill is performance of actions or movements in the correct time sequence with adequate precision. It is characterized by consistency and economy of effort. Economy of effort is achieved by establishing a work pace that represents optimum efficiency.
* It is accomplished by in-creasing mastery of the system through such things as progressive learning of short-cuts, increased speed, and easier access to information or data. Skills are hierarchical in nature, and many basic skills may be integrated to form increasingly complex ones. Lower-order skills tend to become routine and may drop out of consciousness.
* System and screen design must permit development of increasingly skillful performance.

**Individual Differences**:

In reality, there is no average user. A complicating but very advantageous human characteristic is that we all differ-in looks, feelings, motor abilities, intellectual abilities, learning abilities and speed, and so on. In a keyboard data entry task.

For example, the best typists will probably be twice as fast as the poorest and make 10 times fewer errors.

**Human considerations**

**The User's Knowledge and Experience:**

The knowledge possessed by a person, and the experiences undergone, shape the design of the interface in many ways. The following kinds of knowledge and experiences should be identified.

* Computer Literacy - Highly technical or experienced, moderate computer experience, or none
* System Experience - High, moderate, or low knowledge of a particular system and its methods of interaction
* Application Experience - High, moderate, or low knowledge of similar systems
* Task Experience - Other Level of knowledge of job and job tasks
* Systems Use - Frequent or infrequent use of other systems in doing job
* Education - High school, college, or advanced degree
* Reading Level - Less than 5th grade, 5th-12th, more than 12th grade
* Typing Skill - Expert (135 WPM), skilled (90 WPM), good (55 WPM), average(40 WPM), or "hunt and peck" (10 WPM).
* Native Language or Culture- English, another, or several

**JOB/TASK/NEED**

* Type of System Use -Mandatory or discretionary use of the system.
* Frequency of Use -Continual, frequent, occasional, or once-in-a- lifetime use of system
* Task or Need importance - High, moderate, or low importance of the task being performed
* Task Structure - Repetitiveness or predictability of tasks being automated, high, moderate, or low
* Social Interactions - Verbal communication with another person required or not required
* Primary Training - Extensive or formal training, self-training through manuals, or no training
* Turnover Rate - High, moderate, or low turnover rate for jobholders
* Job Category- Executive, manager, professional, secretary, clerk
* Lifestyle - For Web e-commerce systems, includes hobbies, recreational pursuits, and economic status

**PSYCHOLOCICAL CHARACTERISTICS:**

* Attitude - Positive, neutral, or negative feeling toward job or system
* Motivation - Low, moderate, or high due to interest or fear
* Patience - Patience or impatience expected in accomplishing goal
* Expectations - Kinds and reasonableness
* Stress Level - High, some, or no stress generally resulting from task performance
* Cognitive Style - Verbal or spatial, analytic or intuitive, concrete or abstract
* Age Young middle aged or elderly
* Gender Male or Female
* Handness Left, right or ambidextrous
* Disabilities Blind, defective vision, deafness, motor handicap

**Human interaction speeds.**

The speed at which people can perform using various communication methods has been studied by a number of researchers.

**Reading**:

* The average adult, reading English prose in the United States, has a reading speed in the order of 250-300 words per minute.
* Proof reading text on paper has been found to occur at about 200 words per minute, on a computer monitor, about 180 words per minute.
* One technique that has dramatically increased reading speeds is called Rapid Serial Visual Presentation, or RSVP.
* In this technique single words are presented one at a time in the center of a screen. New words continually replace old words at a rate set by the reader.
* For a sample of people whose paper document reading speed was 342 words per minute? (With a speed range of 143 to 540 words per minute.)
* Single words were presented on a screen in sets at a speed sequentially varying ranging from 600 to 1,600 words per minute. After each set a comprehension test was administered Prose text - 250-300 words per minute.
* Proof reading text on paper - 200 words per minute. Proofreading text on a monitor - 180 words per minute.

**Listening**

* Speaking to a computer:
* 150-160 words per minute.
* After recognition corrections: 105 words per minute.

**Keying**

* Typewriter
* Fast typist: 150 words per minute and higher Average typist: 60-70 words per minute Computer
* Transcription 33 words per minute
* Composition: 19 words per minute
* Two finger typists Memorized text: 37 words per minute
* Copying text: 27 words per minute
* Hand printing Memorized text: 31 words per minute.
* Copying text: 22 words per minute.

**UNIT-3**

**SCREEN DESIGNING**

**Interface Design Goals**

* Reduce visual work
* Reduce intellectual work
* Reduce memory work
* Reduce mentor work
* Eliminate burdens or instructions
* The result will always be improved user productivity and increased satisfaction

**Screen meaning and purpose**

* Each screen element. . .
* Every control
* All text
* Screen organization
* All emphasis
* Each color
* Every graphic
* All screen animation
* All forms of feedback
* Must Have meaning to screen users
* Serve a purpose in performing tasks

All elements of a screen must have meaning to users and serve a purpose in per-forming tasks or fulfilling needs. If an element does not have meaning, do not include it on the screen because it is noise.

**Organizing screen elements,**

Visual clarity is achieved when the display elements are organized and presented in meaningful and understandable ways.

A clear and clean organization makes it easier to recognize screen’s essential elements and to ignore its secondary information when appropriate.

Clarity is influenced by a multitude of factors: consistency in design, a visually pleasing composition, a logical and sequential ordering, the presentation of the proper amount of information, groupings, and alignment of screen items.

**Consistency**

Provide real world consistency.

Reflect a person’s experiences, work conventions, and cultural conventions Provide internal consistency. Observe the same conventions and rules for all aspects of an interface screen, and all applications or web site screens, including:

* operational and navigational procedures
* visual identity or theme
* Component
* Follow the same conventions
* Deviate only when there is clear benefit to user

**Ordering of screen data and content**

* Divide information into units that are logical, meaningful and sensible.
* Organize by interrelationships between data or information.
* Provide an ordering of screen units of elements depending on priority.
* Possible ordering schemes include
* Conventional
* Sequence of use
* Frequency of use
* Function
* Importance
* General to specific
* Form groups that cover all possibilities.
* Ensure that information is visible.
* Ensure that only information relative to task is presented on screen.
* Organizational scheme is to minimize number of information variables

**Upper -Left Starting Point**

Provide an obvious starting point in the screen’s upper left corner. Eyeball fixation studies indicate that in looking at displays of information, usually one’s eyes move first to the upper-left center of the display, and then quickly move through the display in a clockwise direction.

Streveler and Wasserman (1984) found that visual targets located in the upper-left quadrant of a screen were found fastest and those located in the lower-right quadrant took longest to find. Provide an obvious starting point in the upper-left corner of the screen.

This is near the location where visual scanning begins and will permit a left-to-right, top-to-bottom reading of information or text as is common in Western cultures.

**Screen navigation and flow,**

* Provide an ordering of screen information and elements that:
* Is rhythmic guiding a person’s eye through display encourages natural movement sequences. Minimizes pointer and eye movement distances.
* Locate the most important and most frequently used elements or controls at top left. Maintain top to bottom, left to right flow.

Assist in navigation through a screen by

* Aligning elements
* Grouping elements
* Use of line borders

Through focus and emphasis, sequentially, direct attention to items that are

1. Critical

2. Important

3. Secondary

4. Peripheral

Tab through window in logical order of displayed information.

* locate command button at the end of the tabbing order sequence, when groups of related information must be broken and displayed on separate screens, provide breaks at logical or natural points in the information flow.
* In establishing eye movement through a screen, also consider that the eye trends to move sequentially, for example – From dark areas to light areas From big objects to little objects From unusual shapes to common shapes.
* From highly saturated colors to unsaturated colors. These techniques can be initially used o focus a person’s attention to one area of the screen and then direct it elsewhere.
* Maintain top to bottom, left to right through the screen. This top to bottom orientation is recommended for information entry for the following reasons – Eye movements between items will be shorter. Control movements between items will be shorter.
* Groupings are more obvious perceptually. When one’s eyes moves away from the screen and then back, it returns to about same place it left, even if it is seeking next item in sequence.
* Most product style guides recommend a left to right orientation. Our earliest display screens reflected this left to right entry orientation.
* Top to bottom orientation is also recommended for presenting displays of read only information that must be scanned.

**Visually pleasing composition**

Provide visually pleasing composition with the following qualities –

* Balance
* Symmetry
* Regularity
* Predictability
* Sequentiality
* Economy
* Unity
* proportion
* Simplicity
* Grouping

**Balance** Create screen balance by providing an equal weight of screen elements, left and right, top and bottom.

**Symmetry** Create symmetry by replicating elements left and right of the screen centerline.

**Regularity** Create regularity by establishing standard and consistently spaced horizontal and vertical alignment points. Also, use similar element sizes, shapes, colors, and spacing.

**Predictabilit**y Create predictability by being consistent and following conventional orders or arrangements.

**Sequentiality Provide** Sequentiality by arranging elements to guide the eye through the screen in an obvious, logical, rhythmic, and efficient manner.

**Economy** Provide economy by using as few styles, display techniques, and colors as possible.

**Unity** Create unity by: — Using similar sizes, shapes, or colors for related information. — Leaving less space between elements of a screen than the space left at the margins.

**Proportion** Create windows and groupings of data or text with aesthetically pleasing proportions. Simplicity (Complexity)

* Optimize the number of elements on a screen, within limits of clarity.
* Minimize the alignment points, especially horizontal or columnar. — Provide standard grids of horizontal and vertical lines to position elements.

**Groupings** Provide functional groupings of associated elements

* Create spatial groupings as closely as possible to five degrees of visual angle
* Evenly space controls within a grouping, allowing 1/8 to 1/4 inch between each.
* Visually reinforce groupings: — Provide adequate separation between groupings through liberal use of white space. — Provide line borders around groups.
* Provide meaningful titles for each grouping.

**Focus and emphasis**

To provide emphasis use techniques such as

* Higher brightness
* Reverse polarity
* Larger and distinctive font
* Underlining
* Blinking
* Line rulings
* Contrasting colors
* Larger size
* Positioning
* Isolation
* Distinctiveness
* White space

**Technological considerations in interface design**.

**Graphical systems**

* Screen design
* Must be compatible with the capabilities of the system
* System power
* Screen size
* Screen resolution
* Display colors
* Other display features
* Screen design must be compatible with the capabilities of the
* Platform compatibility
* Development and implementation
* Platform style guide

**Browser**

* Compatibility
* Monitor size and resolution
* Fonts
* Color
* Bandwidth
* Version other considerations
* Downloading Currency Page
* Printing
* Maintainability

**UNIT-4**

**WINDOWS**

A window is an area of the screen that contains a particular view of some area of the computer or some portion of a person’s dialog with the computer

**Window Characteristics**

* A name or title, allowing it to be identified
* A size in height and width (which can vary)
* Only active windows can have their contents altered
* A window may be partially or fully hidden behind another window
* Information within a window may extend beyond window’s display area Presentation is arranged in relation to other windows (tiled, overlapping, or cascading)
* Methods for manipulation of the window on the screen
* Its highlight, that is, the part that is selected

**Components of a Window**

* Frame
* Title Bar
* Title Bar Icon
* Menu Bar
* Status Bar
* Scroll Bar
* Split Box
* Tool Bar
* Command Area
* Work Area
* Size Grip
* Window sizing Buttons

**Window Operations**

**Primary Window**

* Should represent an independent function or application
* Use to present constantly used window components and controls
* Use for presenting information that is continually updated (Date and time)
* Often called main window or application window
* Do not divide independent function into two or more primary windows

**Secondary Windows**

– **A dependent secondary**

• It can only be displayed from a command on the interface of its primary window

– **A independent secondary**

• Can be opened independently of a primary window (property sheet)

**Modal window**

* Will not permit interaction with another window until the current dialog is completed
* Remain displayed until the appropriate action is taken after which it is removed
* Modal dialog boxes typically request critical information or actions

**Modeless window**

– Switching between the box and its associated is permitted

**Selection of device based and screen based controls.**

Device-based controls, often called input devices, are the mechanisms through which people communicate their desires to the system. Identify the characteristics and capabilities of device- based control

Identify the characteristics and capabilities of device-based control

• Trackball

• Joystick

• Graphic tablet

• Light pen

• Touch screen

• Voice

• Mouse

• Keyboard

**Trackball**

• Description – A ball that rotates freely in all directions in its socket

• **Advantages**

– Direct relationship between hand and pointer movement in terms of direction and speed

– Does not obscure vision of screen

– Does not require additional desk space (if mounted on keyboard)

• **Disadvantages**

– Movement indirect, in plane different from screen

– Requires hand to be removed from keyboard keys

– Requires different hand movements

– May be difficult to control

– May be fatiguing to use over extended time

**Joystick**

**• Advantages**

– Direct relationship between hand and pointer movement in terms of direction and speed

– Does not obscure vision of screen

– Does not require additional desk space (if mounted on keyboard)

• **Disadvantage**

– Movement indirect, in plane different from screen

– Requires hand to be removed from keyboard keys

– Requires different hand movements

– May be difficult to control

– May be fatiguing to use over extended time

– May be slow and inaccurate

**Graphic (Touch) Tablet**

• **Description**

– Pressure, heat, light, or light-blockage

-sensitive horizontal surfaces that lie on the desktop or keyboard

– May be operated with fingers, light pen, or objects like pencil

• **Advantages**

Direct relationship between hand and pointer movement in terms of direction and speed

– Does not obscure vision of screen

– More comfortable horizontal operating plane

• **Disadvantage**

– Movement is indirect, in a plane different from screen

– Requires hand to be removed from keyboard

– Requires different hand movements to use

– Finger may be too large for accuracy with small objects

**Touch Screen**

**• Advantages**

– Direct relationship between hand and pointer movement in terms of direction and speed

– Movement is direct, in the same plane as screen

– Requires no additional desk space

• **Disadvantage**

–Finger may obscure part of screen

– Finger may be too large for accuracy with small objects

–Requires moving the hand far from the keyboard to use

– Very fatiguing to use for extended period of time

– May Damage the screen

**Light Pen**

• **Description**

– A special surface on a screen sensitive to the touch of a special stylus or pen

• **Advantage**

– Direct relationship between hand and pointer movement in terms of direction, distance, and speed – Movement is direct, in the same plane as screen

– Requires minimal additional desk space

– Stands up well in high-use environments

– More accurate than finger touching

**Disadvantage**

– Hand may obscure part of screen

– Requires picking it to use

– Requires moving the hand far from the keyboard to use

– Very fatiguing to use for extended period of time

**Voice**

• **Description**

– Automatic speech recognition by the computer

• **Advantage**

– Simple and direct

– Useful for people who cannot use a keyboard

– Useful when the user’s hands are occupied

• **Disadvantage**

– High error rates due to difficulties in

• Recognizing boundaries between spoken words

• Blurred word boundaries due to normal speech patterns –

Slower throughput than with typing

– Difficult to use in noisy environment

– Impractical to use in quiet environment

**Mouse**

**• Advantage**

– Direct relationship between hand and pointer movement in terms of direction, distance, and speed

. – Permit a comfortable hand resting position

– Selection mechanisms are included on mouse

– Does not obscure vision of the screen

• **Disadvantage**

– Movement is indirect, in a plane different from screen

– Requires hand to be removed from keyboard

– Requires additional desk space

– May require long movement distances

– Requires a degree of eye-hand co ordination

**Choose the Proper Screen Based Controls**

Screen Based controls, often simply called controls and sometimes called widgets. By definition, they are graphic objects that represent the properties or operations of other objects.

A control may:

* Permit the entry or selection of a particular value.
* Permit the changing or editing of a particular value.
* Display only a particular piece of text, value, or graphic.
* Cause a command to be performed.
* Possess a contextual pop-up window.

Identify the characteristics and capabilities of the various screen-based controls, including:

* Buttons.
* Text entry/read-only controls.
* Selection controls.
* Combination entry/selection controls.
* Specialized operable controls.
* Custom controls
* Presentation controls.
* Web controls.
* Select the proper controls for the user and tasks

**.Buttons:**

Description: A square or rectangular-shaped control with a label inside that indicates action to be accomplished. The label may consist of text, graphics, or both.

**Purpose**:

* To start actions.
* To change properties.
* To display a pop-up menu.

**Advantages**:

* Always visible, reminding one of the choices available.
* Convenient. Can be logically organized in the work area.
* Can provide meaningful descriptions of the actions that will be performed.
* Larger size generally provides faster selection target.
* Provides visual feedback through button movement when activated.
* May permit use of keyboard equivalents and accelerators.
* Faster than using a two-step menu bar/pull-down sequence.

**Disadvantages**:

* Consumes screen space.
* Size limits the number that may be displayed.
* Requires looking away from main working area to activate.
* Requires moving the pointer to select.

■**Proper usage**: Use for frequently used actions that are specific to a window. To cause something to happen immediately. To display another window. To display a menu of options. To set a mode or property value.

**Command Buttons (Scrolling and Button Activation)**

* Use buttons to move between multi-page forms, not scroll bars Label buttons Next and Previous.
* Highlight the button in some visually distinctive manner when the point is resting on it and the button is available for selection

**Text Entry/Read-Only Controls (Captions)**

* For entry boxes Place a colon (:) immediately following the caption
* For single fields, caption can be located in front of upper-left corner of the box
* For multiple fields, position the caption upper left of the box For read-only boxes
* If the data field is long or about the same length, center the caption above the displayed text box
* If the data is alphanumeric, short, or quite variable in length, left-justify the caption above the displayed
* If the data field is numeric and variable in length, right-justify the caption above the displayed

**Selection Controls**

A selection control presents on the screen all the possible alternatives, conditions, or choices that may exist for an entity, property, or value. The relevant item or items are selected from those displayed.

* Radio Buttons
* Check Boxes
* Palettes
* List Boxes
* List View Controls
* Drop-down/Pop-up List Boxes

**Radio Buttons:**

**Description:**

A two-part control consisting of the following: Small circles, diamonds, or rectangles.

**Choice descriptions**.

When a choice is selected:

The option is highlighted.

Any existing choice is automatically unhighlighted and deselected

**Check Boxes**

Each option acts as a switch and can be either “on” or “off”

When an option is selected, a mark (X) appears within the square box, or the box is highlighted in some other manner Otherwise the square is unselected or empty (off)

Each box can be switched on or off independently used alone or grouped in sets

**Palettes**:

* A control consisting of a series of graphical alternatives.
* The choices themselves are descriptive, being composed of colors, patterns, or images
* To set one of a series of mutually exclusive options presented graphically or pictorially
* Usually consume less screen space than textual equivalents
* Do not use
* Where the alternatives cannot be meaningfully and clearly represented pictorially Where words are clearer than images Where the choices are going to change
* Create boxes of equal size
* Position the boxes adjacent to, or butted up against another
* A columnar orientation is the preferred manner
* Top to button, Left to right ordering by expected order, frequency of occurrence, sequence of use or alphabetically
* Display it less brightly than the other choices, if a choice is not available
* Highlight the choice in some visually distinctive way when the pointer is resting
* When a choice is selected, distinguish it visually from the unselected choices

**List Boxes:**

A permanently displayed box-shaped control containing a list of attributes or objects from which

* –A single selection is made (mutually exclusive), or
* –Multiple selections are made (non-mutually exclusive)
* Unlimited number of choices
* If the list content change, items will be hard to find
* Good for data that are
* Best represented textually
* Not frequently selected
* Large in number
* Fixed in list length
* Clearly and meaningfully
* Describe the choices available
* Present in mixed case
* Left-align into columns
* Require no more than 40 page-downs to search a list
* If more are required, provide a method for using criteria Must be long enough to display 6-8 choices

**Spin Boxes:**

A single line field followed by two small, vertically arranged buttons (pointing up and pointing down arrow)

**Selection/entry is made by:**

* Using the mouse to point at one of directional buttons
* Keying a value directly into field itself

**Advantages:**

* Consumes little screen spaces
* Flexible, permitting selection or typed entry

**Disadvantages:**

* Difficult to compare choices.
* Can be awkward to operate.
* Useful only for certain kinds of data

**Slider:**

* A scale exhibiting degrees of a quality on a continuum
* To make a setting when a continuous qualitative adjustment is acceptable
* Spatial representation of relative setting
* Not as precise as an alphanumeric indication

**UNIT-5**

**Components**

**Icons**

* Icons are most often used to represent objects and actions with which users can interact
* Icons may stand alone on a desktop or in a window, or be grouped together in a toolbar
* A secondary use of a icon is to reinforce important information, a warning icon in a dialog message box

**Characteristics of Icons**

**Syntactic** refers to an icon’s physical structure Shape, Color, Size Similar shapes and colors can be used to classify a group of related icons

**Semantics** is the icon’s meaning what does it refer – a file, a waste basket, or some other objects?

**Pragmatics** is how the icons are physically produced and depicted Is the screen resolution sufficient to illustrate?

Syntactic, semantics and pragmatics determine an icon’s effectiveness and usability

**Influences on Icon Usability**

Provide icons that are

* Familiar
* Clarity
* Simple
* Consistent
* Directness of the meaning
* Efficient
* Discriminable
* from others

Also consider the Context in which the icon is used Expectancies of users Complexity of task

**Choosing Icons**

* A Successful Icon
* Looks different from all other icons
* Is obvious what it does or represents
* Is recognizable when no larger than 16 pixels square
* Look as good in black and white as in color

**Size**

* 16x16, 24x24, 26x26, 32x32 pixels 16-and-256 color version
* Use colors from the system palette
* Provide as large a hot zone as possible
* With stylus or pen: 15 pixels square
* With mouse: 20 pixels square
* With finger: 40 pixels square

**Creating Images**

* Create familiar and concrete shapes
* Create visually and conceptually distinct shapes
* Incorporate unique features of an object
* Do not display within a border Clearly reflect object represented
* Simple reflect object represented, avoiding excessive detail
* Create as a set, communicating relationships to one another through common shapes
* Provide consistency in icon type
* Create shapes of the proper emotional tone
* Create familiar and concrete shapes
* Create visually and conceptually distinct shapes

**Drawing Images**

* Providing consistency in shape over varying sizes
* Do not use triangular arrows in design to avoid confusion with other system symbols
* When icons are used to reflect varying attributes, express these attributes as meaning meaningfully as possible
* Provide proper scale and orientation
* Use perspective and dimension whenever possible
* Accompany icon with a label to assure intended meaning

**Multimedia**

**Images**

* Use standard images,
* image internationalization
* Provide descriptive text or labels with all images
* Distinguish navigational images from decorative images
* Minimize
* The number of presented images
* The size of presented images
* Image animation
* Number of colors
* GIF, JPEG is prefer

**choosing proper colors**

* Color adds dimension, or realism, to screen usability.
* Color draws attention because it attracts a person’s eye.

**Color Uses**

* Use color to assist in formatting
* Relating elements into grouping
* Breaking apart separate groupings of information
* Highlighting or calling attention to important information
* Use color as visual code to identify
* Screen captions and data
* Information from different sources
* Status of information
* Use color to
* Realistically portray natural objects
* Increase screen appeal

**Color in Context**

* Color are subject to contextual effects
* Small adjacent colored images may appear to the eye to merge or mix
* A color on a dark background will look lighter and brighter than the same color on a light background
* Colors also change as light levels change

**Choosing Colors for Categories of Information**

* Color chosen to organize information or data on a screen must aid the transfer of information from the display to the user, Some examples of using color code
* If decisions are made based on the status of information on the screen, color-code the types of status the information
* Screen searching is performed to locate information of particular kind, color-code for contrast
* If the sequence of information use is constrained or ordered, use color to identify the sequence
* If the information on a screen is crowded, use color to provide visual grouping

**INTERACTION DEVICES**

, image and video displays, drivers

**Keyboard Layouts**

* **QWERTY layout** – 1870 Christopher Latham Sholes
* Good mechanical design and a clever placement of the letters that slowed down the users enough that key jamming was infrequent
* Put frequently used letter pairs far apart, thereby increasing finger travel distances

**Dvorak layout**

* 1920
* reduces finger travel distances by at least one order of magnitude
* Acceptance has been slow despite the dedicated efforts of some devotees
* it takes about 1 week of regular typing to make the switch, but most users have been unwilling to invest the effort

**Keys**

* 1/2 inch square keys
* 1/4 inch spacing between keys
* slight concave surface
* matte finish to reduce glare finger slippage
* 40-to 125-gram force to activate
* 3 to 5 millimeters displacement
* tactile and audible feedback important
* certain keys should be larger (e.g. ENTER, SHIFT, CTRL)

**Function keys**

* users must either remember each key's function, identify them from the screen's display, or use a template over the keys in order to identify them properly
* can reduce number of keystrokes and errors
* Meaning of each key can change with each application
* Placement on keyboard can affect efficient use
* Special-purpose displays often embed function keys in monitor bezel
* lights next to keys used to indicate availability of the function, or on/off status – typically simply labeled F1, F2, etc, though some may also have meaningful labels, such as CUT, COPY, etc.
* Frequent movement between keyboard home position and mouse or function keys can be disruptive to use
* Alternative is to use closer keys (e.g. ALT or CTRL) and one letter to indicate special Function

**Pointing Devices**

Pointing devices are applicable in six types of interaction tasks:

**Select:**

* User chooses from a set of items.
* Used for traditional menu selection, identification of a file in a directory, or marking of a part in an automobile design.

**Position:**

* user chooses a point in a one-, two-, three-, or higher-dimensional space
* Used to create a drawing, to place a new window, or to drag a block of text in a figure.

**Orient:** user chooses a direction in a two-, three-, or higher-dimensional space.

Direction may simply rotate a symbol on the screen, indicate a direction of motion for a space ship, or control the operation of a robot arm.

.

**Path**:

* User rapidly performs a series of position and orient operations.
* may be realized as a curving line in a drawing program, the instructions for a cloth cutting machine, or the route on a map

**Quantify:**

* User specifies a numeric value.
* Usually a one-dimensional selection of integer or real values to set parameters, such as the page number in a document, the velocity of a ship, or the amplitude of a sound.

**Text:**

* User enters, moves, and edits text in a two-dimensional space.
* The – pointing device indicates the location of an insertion, deletion, or change.

**Direct-control pointing devices**

• **Lightpen**

–enabled users to point to a spot on a screen and to perform a select, position, or other task

–it allows direct control by pointing to a spot on the display

–incorporates a button for the user to press when the cursor is resting on the desired spot on the screen

–lightpen has three disadvantages: users' hands obscured part of the screen, users had to remove their hands from the keyboard, and users had to pick up the lightpen

**• Touch screen**

* allows direct control touches on the screen using a finger
* early designs were rightly criticized for causing fatigue, hand obscuring-the-screen, hand- off-keyboard, imprecise pointing, and the eventual smudging of the display
* lift-off strategy enables users to point at a single pixel
* the users touch the surface
* then see a cursor that they can drag around on the display
* when the users are satisfied with the position, they lift their fingers off the display to activate
* can produce varied displays to suit the task
* are fabricated integrally with display surfaces

**Indirect pointing devices**

* + **Mouse** – the hand rests in a comfortable position, buttons on the mouse are easily pressed, even long motions can be rapid, and positioning can be precise
  + **trackball** – usually implemented as a rotating ball 1 to 6 inches in diameter that moves a cursor
  + **joystick** --for tracking purposes • graphics tablet – a touch-sensitive surface separate from the screen • touchpad – built-in near the keyboard offers the convenience and precision of a touchscreen while keeping the user's hand off the display surface

**Speech recognition, digitization and generation,**

* Continuous-speech-recognition systems enable users to dictate letters and compose reports verbally for automatic transcription.
* Review, correction, and revision are usually accomplished with keyboards and displays.
* Users need practice in dictation and seem to do best with speech input when preparing standard reports.
* Continuous speech-recognition systems also enable automatic scanning and retrieval from radio or television programs, court proceedings, lectures, or telephone calls for specific words or topics

Speech generation is a successful technology with widespread application in consumer products and on telephones.

When algorithms are used to generate the sound(synthesis),the intonation may sound robot-like and distracting. The quality of the sound can be improved when phonemes, words and phrases from digitized human speech can be smoothly integrated into meaningful sentences.

Text-to-speech utilities like the built-in Microsoft Windows Narrator can be used to read passages of text in web browsers and word processors.

* the messages are simple and short,
* deal with events in time,
* require an immediate response
* when user’s visual channels are overloaded
* They must be free to move around

When the environment is too brightly lit, too poorly lit, subject to severe vibration, or otherwise unsuitable for visual displays.

**Image and video display drivers**

The display has become the primary source of feedback to the user from the computer

– The display has many important features, including:

• Physical dimensions (usually the diagonal dimension and depth)

• Resolution (the number of pixels available)

• Number of available colors, color correctness

• Luminance, contrast, and glare

• Power consumption

• Refresh rates (sufficient to allow animation and video)

• Cost

• Reliability

***Usage characteristics distinguish displays***:

• Portability

• Privacy

• Saliency

• Ubiquity

**Simultaneity**

• Large displays

– Informational wall displays

– Interactive wall displays

– Multiple desktop displays

• Heads-up and helmet mounted displays

– A heads-up display can, for instance, project information on a partially silvered widescreen

of an airplane or car

– A helmet/head mounted display (HMD) moves the image with the user

– 3D images

**Animation, image, and video**

• Accelerated graphics hardware

• More information shared and downloaded on the web

• Scanning of images and OCR

• Digital video

• CDROMS and DVDs

• Compression and decompression through MPEG

• Computer-based video conferencing