HCI

Q.1} How HCI was evolved?

Ans. From the early computers which performed batch processing, we now have come to the user-centered design, the hallmark of HCI.

Q.2} Major milestones in evolution of HCI.

Ans.

1. In early computer, improvement in H/W technology implied massive increase in computing power. People started to think about "how to use this power by equivalent explosion of ideas".
2. By mid 1950's researchers realized the need for VDU. Earliest application that use VDU was SAGE- an air defence system of USA.
3. The development of sketchpad: People started to realize that computer can be used for more than data processing.
4. The idea of personal computer was evolved: Allan Kay developed smalltalk (a visually based programming environment) at Xerox PACK.
5. Windows and WIMP Interfaces:
   Humans are able to think about more than one thing at a time.

In accomplishing some tasks, they frequently interrupt their current train of thought and switch to some other piece of work.

Sequential interaction to complete task is not suitable for this behaviour.

Window system and WIMP interface was developed to take care of this.

WIMP stands for 'Windows Icons Menus Pointer', denoting a style of interaction using these elements of user interface.

It is used to perform simultaneous jobs at one desktop.

6. WWW:
   Tim Berners was the inventor of the most popular application layer protocol (which we used with networks).
   The year 1991 saw the first text based browser.
   The first graphical browser (Mosaic Browser) came in 1993.
7. The idea of metaphor (i.e., representing abstract actions/objects in terms of known artifacts) was evolved: Use of metaphor increases affordance which leads to naturalness of the interface
8. Direct Manipulation:
   Ben Shneiderman coined the term in 1982
   First successful use of the idea in Apple Mac PC.
   Reduces the chances for syntactic errors, learning for command line interfaces.
9. HyperText:
   The idea of Hypertext was first articulated by Vannevar Bush in 1945.

It was known as the Memex System.

Ted Nelson coined the term hypertext in mid 1960 to denote the non-linear structure of text.

Related terms to Hypertext is hypermedia.

10. Multimodality:
    It relies on multiple human communication channel simultaneously for input and output.
11. Computer supported cooperative work:
    CSCW systems were built to support users working in group.
    Computer networks evolved in 1960's.
    Society/sociology comes into picture.
12. Ubiquitous computing:
    It is the most active research area in HCI now. It is also known as pervasive computing.

Q.3} Explain evolution of Windows and WIMP Interfaces and WWW.

Ans.

1.Windows and WIMP Interfaces:

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Q.4} What is Hypertext?

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Related terms to Hypertext is hypermedia.

Q.5} What is Usability Engineering?

Ans. Usability is the effectiveness, efficiency and satisfaction with which users achieve specific goals in particular environments; where

– **Effectiveness** is the accuracy and completeness with which specified users can achieve specified goals in particular environments;

– **Efficiency** is the resources expended in relation to the accuracy and completeness of goals achieved; and

– **Satisfaction** is the comfort (experience) and acceptability of the work system to its users and other people affected by its use.

Usability Engineering is an approach to the development of software and systems which involves user participation from the outset and guarantees the usefulness of the product through the use of usability specification and metrics.

UE thus refers to the usability function aspects of entire process of conceptualizing & testing products from requirements gathering stage to installation & testing pf their use.

Q.6} Define Usability and UE lifecycle.

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The UE lifecycle

UCD Methods (ISO 13407)

SYSTEM LIFE CYCLE						
FEASIBILITY		REQUIREMENTS		DESIGN	IMPLEMENT	RELEASE
USER REQs	CONTEXT OF USE	FUNCTIONAL	TECHNICAL	PROTOTYPE	USEABILITY TESTING	FEEDBACK

Design Stages

Task	Information produced
Knowing the user	User characteristics, User background
Knowing the task	User's current task, Task analysis
User requirements	User requirements specification
Setting usability goals	Usability specification
Design process	Design Specification
HCI Guidelines & heuristic analysis	Feedback for design iteration
Prototyping	Prototype for user testing
Evaluation with users	Feedback for freezing design
Redesign and evaluate with users	Finished product
Evaluate with users and report	Feedback on product for future systems

Q.7} Explain Waterfall Model in brief.

Ans. The waterfall model is the simplest and typical way to visualize software design.

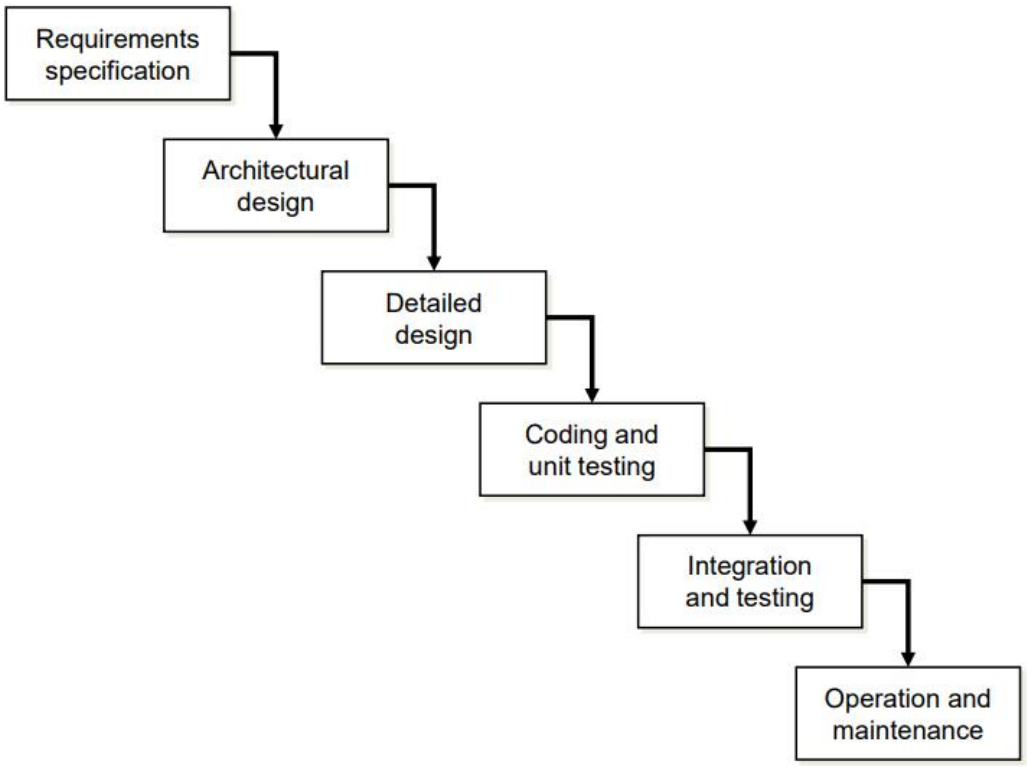
Design process is composed of a series of sub-stages.

Each sub-stage follows the previous stage and precedes the next stage.

The flow of stages are Uni-directional, in which progress is seen as flowing steadily downwards (like a waterfall).

Each stage depends on the previous stages but not vice-versa.

The phases are Requirements specification, Architectural Design, Detailed design, Coding and unit testing, Integration and testing, Operation and Maintenance.



Advantages:

1.Simple and easy to understand and use.

2. Phases are processed and completed one at a time.

3. Works well for smaller projects.

Disadvantages:

1. High amount of risk.

2. Not good model for complex and object oriented projects.

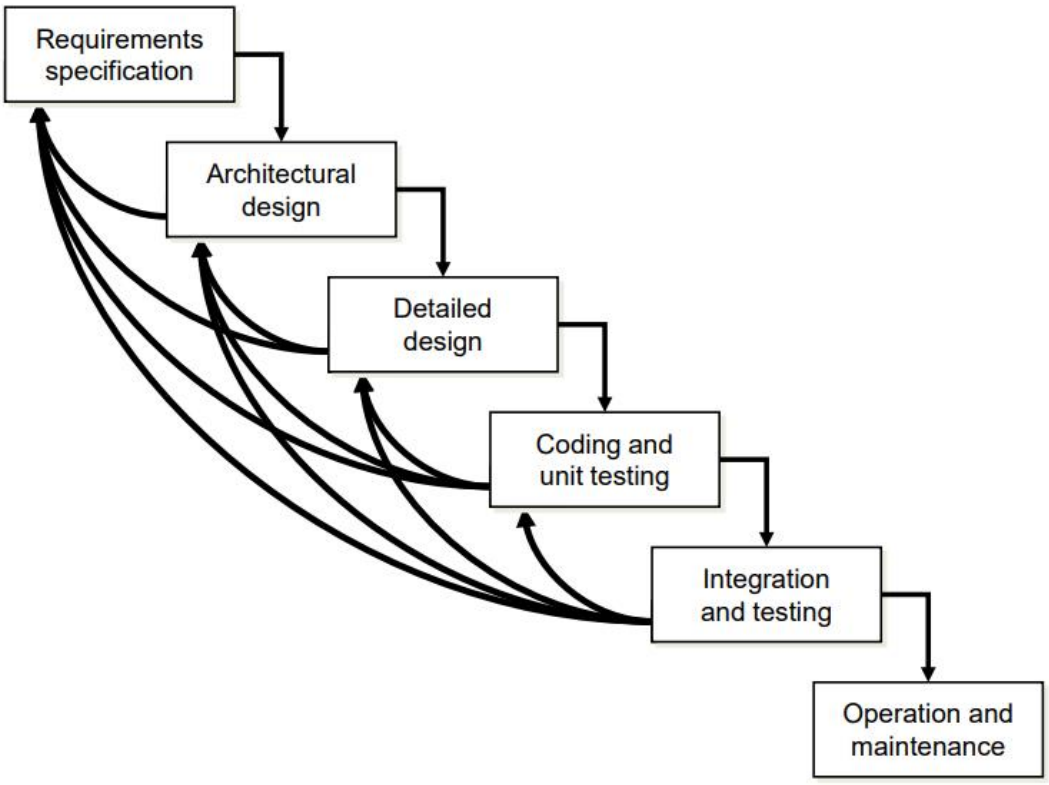
3. Not suitable where requirements are at high risk of changing.

Q.8} Explain Interactive System Design.

Ans. The Uni-directional flow is not appropriate for interactive system design.

In other words, each stage depends on the previous stages. It may also depend on the next stages.

It is no longer the (linear) waterfall model.



Advantages:

1.Interactive systems are easy to use.

2. Getting feedback from the customer is also done with interactive system.

3. It helps business to make long-term relationship between customers.

Disadvantages:

1. Interactive software needs extra hardware and memory resources to perform well.

2. Interactive system cost higher due to its installation and setup.

3. Designing complex and nice graphical interactive systems are difficult and take longer time.

Q.9} What is generic user characterization?

Ans. Users are characterized into 3 categories:

1.Novice or First time users:

This type of users know nothing about the task or interface concepts. They are often worried about the computer and its functionality.

2. Knowledgeable or Intermediate users:

This type of users have stable task concepts and broad interface concpts.

3. Expert Users:

This type of users are thoroughly familiar with the task and interface concepts. They want to get their job quickly done.

Q.10} Explain User Centric Design (UCD) in brief.

Ans. The design process, where designer collects feedback about the design from users and use this to refine design, is known as "user centered design" or UCD.

UCD is based on understanding the domain of work or play in which people are engaged and in which they interact with computers.

Assumptions:

- Result of a good design satisfied to user.
- Process of design is a collaboration between designers and user.
- Design evolves and adapts to users changing concerns and the process produces a specification as an important byproduct.
- The user and designer are in constant communication during the entire process.

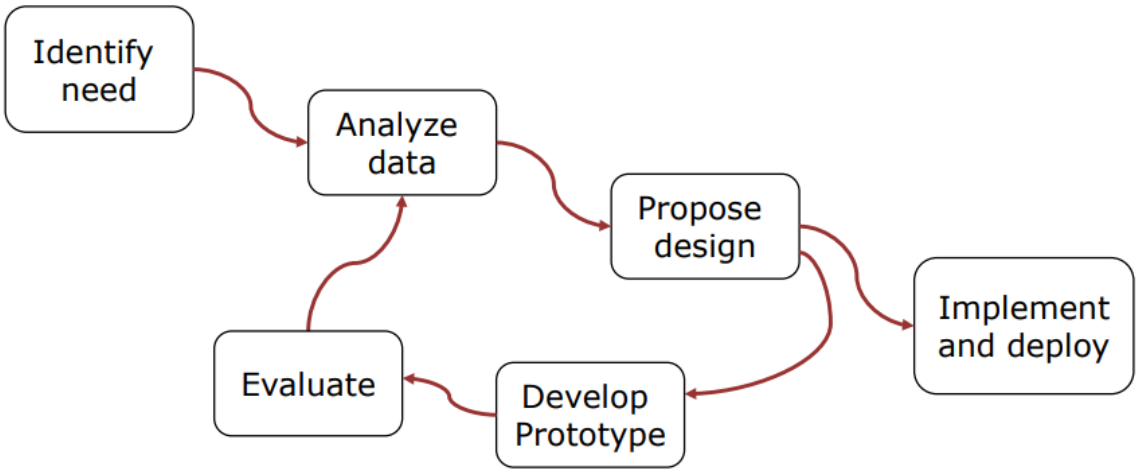
Drawbacks:

In UCD, user involvement is "passive":

- The designer obtains feedback from user (through interviews, informal discussions etc)
- Prepares specification on the basis of user response.
- Take feedback on the design and makes refinements.
- User intuition about a new interface may not be correct
- The interview process itself may not be formulated properly.
- It is not possible for the designer to identify all possible issues to take feedback from users, as the designer's knowledge about the user may not be complete.

Q.11} Explain life cycle stages of Interactive Model with consolidated diagram.

Ans.



Stage 1: Identify Need:

Designers identify users and their needs. They make use of one or more methods to identify the requirements. Such methods includes Interview, User models, cultural probes, contextual inquiry, etc.

Stage 2: Analyze Data:

The data collected by the user is analyzed in this stage. Two types of analysis is performed:

a.Scenario analysis: The data collected from user is analyzed on one or more usage scenario of the system.

b.Task Analysis: Analysis of tasks required to be carried out by the user to operate the system are analyzed.

System level task analysis: External tasks required to operate the system.

Cognitive task analysis: Tasks performed in the mind of user.

Stage 3: Propose Design:

In this stage, Design proposal is arrived from the analysis of collected data. Guidelines and principles help designer in development of initial design.

Stage 4: Develop Prototype:

In this stage, designer implements a prototype of the design for collecting user feedback. Prototype is build in the form of Paper Prototype and Complete Software.

Stage 5: Evaluate Design:

Evaluation of design by users takes place.

In the initial design phase, evaluation is done on prototypes. It is cost effective and easier to perform. It is suitable for iterative design process where the evaluation is performed many times.

The full system is evaluated at the end. Full system evaluation is costly in terms of money, manpower, time and efforts. Hence, it is typically done once or a limited number of times.

Q.12} What is GUI? What are the requirements of GUI?

Ans. The interface through which a user operates a program or an application or an device is known as GUI.

It consists of individual or group of icons, buttons, scroll bars, menus, widgets, boxes, labels, instructions, visuals etc - arranged on the screen in a pattern that is visually pleasing to eye.

It is Very important and critical component in facilitating user interaction with the software & hardware inside the device / product.

GUI determines the usability Index of the product and gives the product an identity, personality & character. It means the more the program / application is attractive, the more number of users will use it.

Requirements of a GUI:

It should be:

1.FUNCTIONAL: It should be useable, easy to operate, locate what is required & where it is required on the screen & do what is expected by it.

2.AESTHETIC: It should be pleasing to eye, identifiable, distinct, recognizable and should have highest visual quality.

3.COMMUNICABLE: It should express what it represents and how it is to be operated. Also it should be culturally & contextually compatible.

Q.13} What are the principles of the design?

Ans. Design is composed of manipulating the physical characteristics of size, shape, texture, proportion, scale, mass and color.

Principles of Design:

The Principles of Design can be thought of as what we do with the elements of design to express and communicate a predetermined message of Usability, Reliability, & Functionality in a harmonious fashion.

1.Balance: Also known as visual balance. It checks whether the elements are visually balanced in terms of their size, shape , weight.

2.Unity: Unity is an overall sameness through out the screen. It checks how properly all elements blend together.

3. Proportion: It is the size relationship found within an object or design. It is a comparison in terms of ratio of size, shape, etc. with other elements.

4.Rhytm: Rhythm is created when one or more elements of design ae used repeatedly to create a feeling of organized movement / direction.

5.Movement: Movement is the path the viewers takes through the artwork. Animation is most used as artwork.

6.Emphasis: This is the part of the design that catches the viewer's attention. The designer will make one area stand out by using the elements of design in contrasting way.

7.Contrast: It highlights similarities, differences and diversities.

Q.14} Differentiate between Warm color and Cool color.

Ans.

Warm Colors	Cool Colors
1. Warm colors are energetic.	1. Cool colors are calm.
2. Warm colors consists of red, yellow, orange, or a mixture of these colors.	2. Cool colors consists of blue, green, and purple, or a mixture of these colors.
3. Warm colors make objects look like they’re closer than they really are.	3. Cool colors make objects look farther away or smaller.
4. Warm colors simultaneously evoke feeling of energy.	4. Cool colors are soothing in nature and tend to be more relaxing.
5. Warm colors are connected emotionally with warmth.	5. Cool colors are connected emotionally with trust.

Q.15} What is clustering principles of design?

Ans. Organizing the screen into visually separate blocks of similar controls, preferably with a title for each block.

Modern WIMP (Windows-Icons-MenusPointer) systems are a natural expression of the Clustering Principle.

Information on a screen which is not categorized into some order can be confusing.

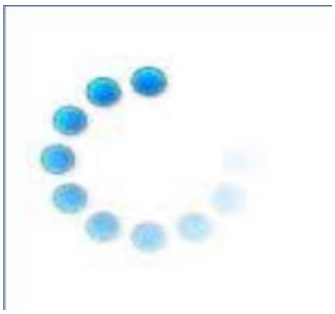
GRIDS are therefore used to not only to align & please aesthetically but also categorise UI elements according to functions.

Font type and size are taken into consideration in clustering principles. For example: One or two types of styles are sufficient to avoid clustering.

Regional fonts should be avoided as they have unresolved problems when used in low resolution & small display screens which leads to clustering in design.

Q.16} Write case study on Icon Design?

Ans.



Both the icons are graphically simple, do the function of informing the status & are not complicated to understand.

They use gradient in colors (monochrome) to depict time progress through animation. The circular form express the abstract concept of time.

The state of 'please wait' is expressed in a pleasant peaceful unhurried manner.

In terms of construction, the icons do not take expensive screen real estate and need very less computing memory also are friendly to both pixel as well as vector graphics.

The icon has achieved this by employing aesthetic principles in their form, colour, shape, configuration, motion & composition – all of them are put together totally resulting in a simple 'design'.

Q.17} Explain prototypes in HCI.

Ans. A prototype is essential model of the system.

The prototype can have limited or full range of functionalities of proposed system.

It is widely used technique in engineering where products are tested by a prototype.

Prototypes can be throw away (i.e. are thrown away after they serve their purpose) or can go into commercial use.

Prototypes can be Paper based: likely to be thrown after use & Software based: can support few or all functionalities of system and may develop into final product.

Work flow, task design, screen layout, critical areas are need to be evaluated using prototype.

Prototypes take many forms: storyboard, power point slide show, piece of software with limited functionality, lump of wood.

Prototypes are categorized in three groups: Low fidelity prototypes, Medium fidelity prototypes, high fidelity prototypes.

1.Low fidelity prototypes:

These are often paper based and do not allow user interactions. They range from a series of hand drawn layouts to printouts.

In low fidelity, sketches are quicker to create. In a sketch, the outward appearance of the intended system is drawn. Such approximation helps people concentrate on high level concepts.

Storyboarding is scenario based prototyping. A series of sketches of the keyframes are drawn. It helps user to evaluate interaction unlike sketches.

Pictiv method uses readily available materials to prototype designs such as sticky notes and represents different interface elements such as icons, menus, windows, etc.

2. Medium fidelity prototypes:

These prototypes are built using computers and are more powerful than low fidelity prototypes. It simulated some but not all functionalities of system.

It is more engaging for end user as the user gets can better feeling of the system.

It is broadly of two types:

Vertical Prototype where in-depth functionalities of limited number of selected features are implemented. Ex. Working of a single menu item in full.

Horizontal Prototype where the entire interface is implemented without any functionality. No real task can be performed with such prototypes.

Computers are more useful to implement scenarios as they provide many useful tools like power point slides, animation.

3. High fidelity prototype:

It is typically a software implementation of the design with full of functionalities. It requires money, manpower, time and effort.

(NEXT POINT AFTER HIGH FIDELITY PROTOYPE)

Prototypes are designed and used in following ways:

Throw away: Once the purpose is served, they are thrown away. Done in low and medium fidelity prototypes.

Incremental: Product is built separately, and after is component is prototyped and tested, it is added to final system.

Evolutionary: A single prototype is refined after testing which evolve to the final product.

Q.18} Explain Prototyping Tools.

Ans. For medium and high fidelity prototypes several tools are available:

Drawing tools such as Adobe Photoshop, MS Visio can be used to develop sketch/storyboards.

Presentation software such as MS Power Point which integrates drawing support are also suitable for low fidelity prototypes.

Media tools such as Adobe flash can be used to develop storyboards. Scene transition is achieved by simple user inputs such as key press and mouse clicks.

Interface Builders such as VB, Java Swing with their widget libraries are useful for implementing screen layouts easily. The interface builders also supports rapid implementation of vertical prototyping through programming with their extensive software libraries.

HCI Assignment No. 4

Q1. What is model based design and types of model?

Ans.

A 'model' in HCI refers to "a representation of the user's interaction behaviour under certain assumptions". The model represents behaviour of average users, not individuals.

Types of Models:

a. Descriptive/prescriptive models: Some models in HCI are used to explain/describe user behavior during interaction in qualitative terms. An example is the Norman's model of interaction
b. Predictive engineering models: these models can "predict" behavior of a user in quantitative terms. An example is the GOMS model.

It has 3 types:

- Formal (system) models
- Cognitive (user) models
- Syndetic (hybrid) model

i. Formal (system) models:

In these models, the interactive system (interface and interaction) is represented using 'formal specification' techniques

ii. Cognitive (user) model:

These models capture the user's thought (cognitive) process during interaction – For example, a GOMS model tells us the series of cognitive steps involved in typing a word .

Essentially models are the 'internal aspects' of interaction (what goes on inside user's mind).

iii. Hybrid Model:

In this model, both the system (external aspect) and the cognitive activities (internal aspect) are combined and represented using formal specification.

- **Types of Cognitive models:**

1. **Simple models of Human information processing:**

   These are the earliest cognitive models used in HCI. These model complex cognition as a series of simple (primitive/atomic) cognitive steps.

2. **Individual models of human factors:**

   In this approach, individual human factors such as manual (motor) movement, eye movement, decision time in the presence of visual stimuli etc. are modeled.

3. **Integrated Cognitive Approaches:**

   Here, the whole human cognition process (including perception and motor actions) is modeled. Models capture the complex interaction between different components of the cognitive mechanism unlike the first approach. It Combines

all human factors in a single model unlike the second approach.

- **Limitations of Model based design:**
  - Reduce the need for real users in ISLC.
  - They can not completely eliminate the role played by real users.
  - We still need to evaluate designs with real users during the final stage.
  - Model-based design can be employed in the initial design stages.
  - The present models are not complete in representing average end user.
  - The models can not capture individual user characteristics.

Q2. Explain KLM model with its work.

Ans.

This is the earliest model to be proposed in the GOMS family (and one of the first predictive models in HCI).

- **KLM Purpose:**
  The model provides a quantitative tool (like other predictive engineering models).
  The model allows a designer to 'predict' the time it takes for an average user to execute a task using an interface and interaction method.
  For example, the model can predict how long it takes to close this PPT using the "close" menu option
- **How KLM works?**
  The method of breaking down a higher-level cognitive activity into a sequence of elementary steps is simple to understand, provides a good level of accuracy and enough flexibility to apply in practical design situations.
  For example, a key press, mouse button press and release etc.
  we need to specify the design to the point where keystroke (operator)-level actions can be listed for the specific task scenarios.
  – Look up the standard execution time for each operator.
  – Add the execution times of the operators in the list.

- **The idea of operators:**
  Elementary cognitive steps are known as operators.

  a. **Physical Operator:**

There are five operators, that represent five elementary motor actions with respect to an interaction:

Operator	Description
K	The motor operator representing a key-press
B	The motor operator representing a mouse-button press or release
P	The task of pointing (moving some pointer to a target)
H	Homing or the task of switching hand between mouse and keyboard
D	Drawing a line using mouse (not used much nowadays)

b. Mental Operator:
The core thinking process is represented by single operator 'M' known as Mental operator.

c. System Response operator:
KLM originally defined an operator R, to model the system response time (e.g., the time between a key press and appearance of the corresponding character on the screen).

Q3. Explain GOMS model.

Ans.

- **KLM vs GOMS:**
  - KLM is linear based process and GOMS is hierarchical cognitive (thought) process.
  - Both assumes error free and logical behavior.

- **GOMS Means:**
  - **Goals**: represents what the user wants to achieve, at a higher cognitive level. This is a way to structure a task from cognitive point of view. Goal allows us to model a cognitive process hierarchically.
  - **Operators:** elementary acts that change user's mental (cognitive) state or task environment. This is similar to the operators we have encountered in KLM, but here the concept is more general.
  - **Methods:** these are sets of goal-operator sequences to accomplish a sub-goal.
  - **Selection rules**: sometimes there can be more than one method to accomplice a goal. Selection rules provide a mechanism to decide among the methods in a particular context of interaction.

- **Operators in GOMS:**
  - The major difference is that in KLM, only seven operators are defined. In GOMS, the notion of operators is not restricted to those seven.

- The operator can be defined
  –At the keystroke level (as in KLM) .
  – At higher levels (for example, the entire cognitive process involved in "closing a file by selecting the close menu option" can be defined as operator).

- **Example:**

a. example of using the GOMS model to search for a file in a file manager:

1. **Goal:** Find a specific file in the file manager.
2. **Operators**: a. Move mouse pointer to the search bar
   b. Click the search bar
   c. Type in the name of the file
   d. Press Enter
3. **Methods**: a. Use the mouse to move the pointer to the search bar. b. Click the left mouse button to select the search bar. c. Use the keyboard to type in the name of the file. d. Press the Enter key to start the search.
4. **Selection rules**: a. If the file name is long and/or difficult to spell, use the keyboard to type in the name. b. If the file name is short and/or easy to spell, use the mouse to click on the search bar and type in the name.

Q4. What is Fitts law?

Ans.

It is a law governing the manual (motor) movement. It is one of the earliest predictive models used in HCI. It was First proposed by PM Fitts (hence the name) in 1954. It mainly models the way we move our hand and fingers.

- **Fitts law characterization:**
  - The movement is related to some "target acquisition task" (i.e., the human wants to acquire some target at some distance from the current hand/finger position).
  - The movement is rapid and aimed (i.e., no decision making is involved during movement).
  - The movement is error-free.
- **Why Fitts law is descriptive Model?**
  - Because it provides "throughput", which is a descriptive measure of human motor performance.
- **Why Fitts law is predictive Model?**
  - Because it provides a prediction equation (an analytical expression) for the time to acquire a target, given the distance and size of the target.

Q5. Why Fitts law is descriptive and predictive?

Ans.

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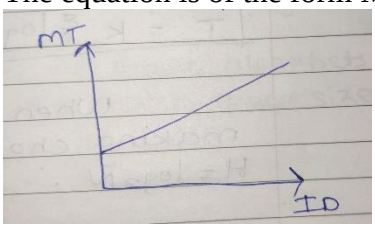
- **Why Fitts law is predictive Model?**
  - Because it provides a prediction equation (an analytical expression) for the time to acquire a target, given the distance and size of the target.
  - Fitts law also allows us to predict performance, That means, we can "compute" performance.
  - The predictive equation is obtained by linearly regressing MT (movement time) against the ID (index of difficulty), in a MT-ID plot.
  - The equation is of the form MT = a + b.ID.



Q6. How width and distance depends in Fitts law?

Ans.

Fitts law is a law governing the manual (motor) movement. It is one of the earliest predictive models used in HCI. It was First proposed by PM Fitts (hence the name) in 1954. It mainly models the way we move our hand and fingers.

- **Distance (D):** the distance by which the person needs to move his hand/finger. The larger the D is, the harder the task becomes.
- **Width (W):** the difficulty also depends on the width of the target to be acquired by the person. As the width increase, the task becomes easier.

- **Measuring task difficulty:**
  From the analysis of empirical data, Fitts proposed the following relationship between ID, D and W:

$$ID = \log_2(D/W+1)$$

Q7. Explain about throughput with real world example.

Ans.

Fitts also proposed a measure called the index of performance (IP), now called throughput (TP). Computed as the difficulty of a task divided by the movement time to complete the task.

Thus, TP = ID/MT bits/s

- **Implication of Throughput:**
  It actually refers to a measure of performance for rapid, aimed, error-free target acquisition task.
  In other words, throughput should be relatively constant for a test condition over a wide range of task difficulties.
- **Throughput – Design Implication:**
  The central idea is - Throughput provides a means to measure user performance for a given test condition.
- **Example:**
  Suppose we got throughput TP1 & TP2 for mouse and touchpad experiments respectively.
  Compare TP1 & TP2. If TP1 is greater than TP2, mouse gives better performance. The touchpad provides better performance if TP2 is greater than TP1.
  They are of same performance if TP1==TP2.

Q8. Explain Hick-Hyman Law.

Ans.

The law which tells us reaction time (time to react to a stimulus) of a person in a presence of choices.

The Hick-Hyman law can be used to predict the reaction times (also called choice-reaction time) under uncertainty (the presence of choices).

We know that a measure of uncertainty is entropy (H).

Thus, T α H

let, pi be the probability of making the i^{th} choice.

Therefore,

$$T = k\sum_{i=1} p_i \log_2(1/p_i)$$

Q9. What is Virtual Keyboard?

Ans.

Physical keyboards makes the system bulky and reduces the mobility.

Sometimes the user may not have the requisite motor control to operate physical keyboards. In such scenario, VKs are useful.

QWERTY layout key arrangement is suitable for two-hand typing.

Since QWERTY layout is good for two hand typing, we have to find out alternative "efficient" layout.

Efficiency, in the context of keyboards in general and VK in particular, is measured in terms of character entry speed (characters/sec or CPS, words/min or WPM etc).

Mathematically, for a N character keyboard, we have to determine the best among N! possible key arrangements.

If N = 26 letters of English alphabet + 10 numerals = 36, the search space size is 36!.

- **Drawback:**
  We can not check all the alternatives in the search space.

Q10. Explain GOMS Analysis in Virtual Keyboard.

Ans.

We can compare the designs in the subset using a GOMS analysis (also called CTA or cognitive task analysis).

- **What is a task here?**
  - To input a series (string) of characters with the VK.
  - We should have a representative task.
  - The string of characters that we chose should represent the language characteristics.

- **Unigram:**
  One simple approach is to consider unigram character distribution, which refers to the frequency of occurrence of characters.

- **Bigram Distribution:**
  It is he frequency of occurrence of character pairs.

- **Corpus:**
  It refers to a collection of texts sampled from different categories.
  Ex. Stories, prose, poem, technical articles, newspaper reports, mails.

Q11. What is cross entropy?

Ans.

- Let X be a random variable which can take any character as its value.
- Let P be the probability distribution function of X [i.e., P(xi) = P(X = xi)].
- We can calculate the "entropy", a statistical measure, of P in the following way:

$$H(P) = -\sum_i P(x_i) \log_2 P(x_i)$$

- The cross-entropy measure can be used to determine similarity of the two distributions:

  Closer H(P,M)
- Take random samples of texts from the corpus and determine the unigram character distribution of the sample text, which is M.
- Next, calculate H(P,M).
- The sample text for which H(P,M) is closest to H(P) will be our representative text.

- **Problems with GOMS based CTA:**
  The text is usually large (typically >100 characters to make it reasonably representative), which makes it tedious to construct GOMS model.

- **Design Approach:**
  We saw the problem with GOMS in VK Design.
  We need to approach that is not task based.
  Fitts' Law and Hick-Hyman Law can be useful for the purpose as they do not require task-based analysis

Q12. How FD model is used in Virtual Keyboard (VK)?

Ans.

FD model was proposed to compute user performance for a VK from layout specification.

The FD model has three components:

a) **Visual Search Time (RT):**
   It is the time taken by a user to locate a key on the keyboard.

$$RT = a + b \log_2 N$$

   N is the total number of keys, a and b are constants.

b) **Movement time (MT):**
   It is the time taken by the user to move his hand/finger to the target key.

$$MT_{ij} = a' + b' \log_2\left(\frac{d_{ij}}{w_j} + 1\right)$$

MT is the movement time to the base i, j which is the movement time from the source i to target j key.

d_{ij} is the distance.

W_j is the width.

Performance is measured in terms of CPS/WPM.

Performance is of two categories of users, namely novice and expert users.

c) Diagraph probability:

Probability of occurrence of character pairs or digraphs, which is determined from a corpus.

$$P_{ij} = f_{ij} / \sum_{i=1}^{N} \sum_{j=1}^{N} f_{ij}$$

Pij is the probability of occurrence of the i-th and j-th key whereas fij is the frequency of the key pair in the corpus.

- **Novice User Performance:**

They are assumed to be unfamiliar with the layout. Hence, such users require time to search for the desired key before selecting the key.

$$CPS_{Novice} = \frac{1}{RT + MT_{MEAN}}$$

$$WPM = CPS \times (60 / W_{AVG})$$

W_{AVG} is the average number of characters in a word.

- **Expert User Performance:**

An expert user is assumed to be thoroughly familiar with the layout. Hence, such users don't require visual search time.

$$CPS_{Expert} = \frac{1}{MT_{MEAN}}$$

$$WPM = CPS \times (60 / W_{AVG})$$

W_{AVG} is the average number of characters in a word.

Q13. What is Metropolis Algorithm. Explain with steps and algorithm.

Ans.

It is widely used to search for the minimum energy (stable) state of molecules in statistical physics.

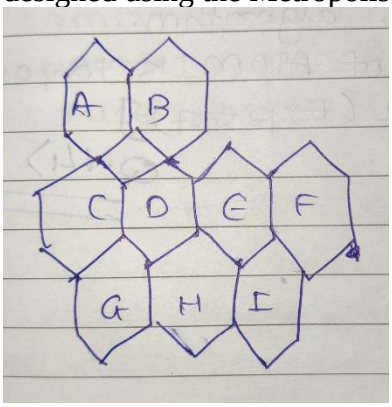
- **Step 1:**We map a layout to a molecule (keys in the layout serves the role of atoms)

- **Step 2:** We redefine performance as the average movement time, which is mapped to energy of the molecule
- **Step 3:** Thus, our problem is to find a layout with minimum energy.

❖ **Steps of the Algorithm:**

- Random walk: pick a key and move in a random direction by a random amount to reach a new configuration (called a state).
- Compute energy (average movement time) of the state.
- Decide whether to retain new state or not and iterate.

- An example VK layout, called the Metropolis layout, is shown, which was designed using the Metropolis algorithm:



Q14. Explain some VK layout performance.

Ans.

- QWERTY
  - 28 WPM (novice)
  - 45.7 WPM (expert)
- FITALY
  - 36 WPM (novice)
  - 58.8 WPM (expert)
- OPTI II
  - 38 WPM (novice)
  - 62 WPM (expert)

- The layouts mentioned before were not designed using models .
- They were designed primarily based on designer's intuition and empirical studies.
- However, the performances shown are computed using the FD model.
- ATOMIK – a layout designed using slightly modified Metropolis algorithm.
- Performance of the ATOMIK layout
  – 41.2 WPM (novice)
  – 67.2 WPM (expert)

HCI Assignment No. 5

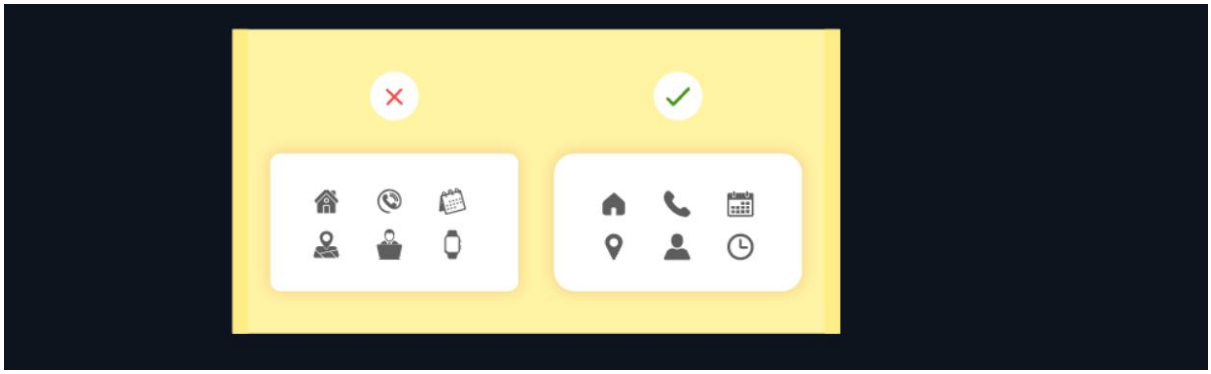
Q1. What are Schneiderman eight golden rules?

Ans.

1. **Strive for consistency:**

Your target audience should not have to wonder whether different words, situations, or actions mean the same thing. In other words, use all elements across your application consistently. For example, a certain style of the button should always do the same thing, or navigation should function logically, going deeper into the hierarchy.

Do not confuse your user — keep words and actions consistent.



2. **Seek Universal Usability:**

The design should cater to both inexperienced and experienced users. This can be done by the use of shortcuts, which can be hidden from novice users. It can speed up the interaction for the expert user and the design can simultaneously cater to both the inexperienced and the experienced user.

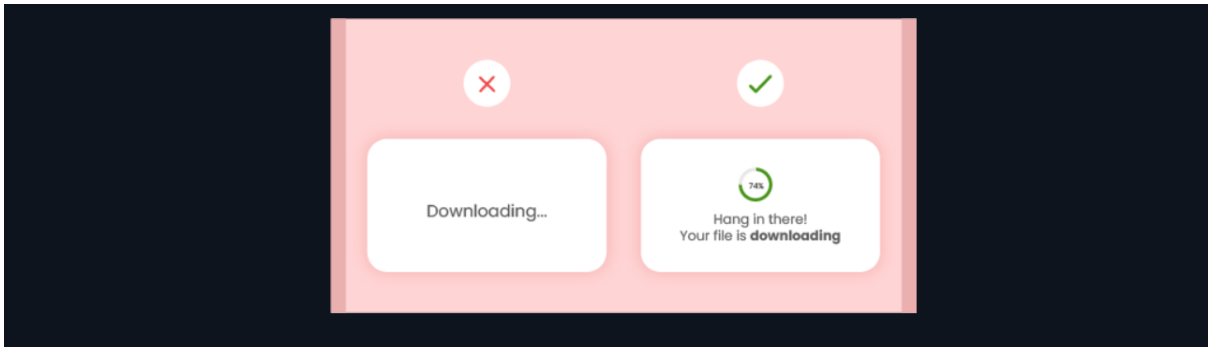
Flexible processes can be carried out in different ways so that people can pick whichever method works for them. Allow users to tailor frequent actions.

3. **Offer Informative Feedback:**

The design should always keep users informed about what is going on. Don’t keep the users guessing — tell them what’s happening. Do this through appropriate feedback within a reasonable amount of time.

When users know the current system status, they learn the outcome of their prior interactions and determine next steps. Predictable interactions create trust in the product and the brand.

Users don’t like surprises. They want to be in control and trust that the system behaves as expected.

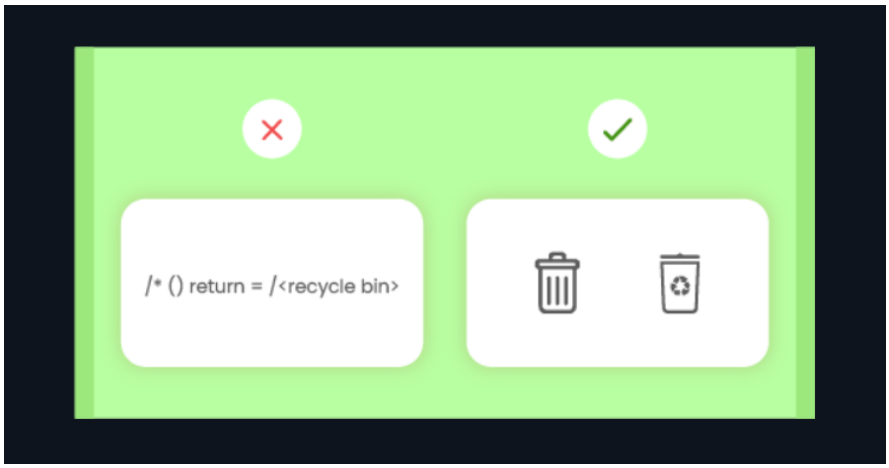


4. **Design dialogs to yield closure:**

The design should speak the language of your target audience. You should always use words, phrases, and concepts familiar to them, rather than internal language. The less the users have to guess, is much better. Make use of universal terms, making the information easier to understand and sound more natural.

The way you design depends very much on your specific users. Terms, concepts, icons, and images that seem perfectly clear to you as a professional may be unfamiliar or confusing to your users.

All sequences of actions should be organized into groups with a clear beginning, middle, and end. When a process is finished, always display a notification message, letting the user know that they have done all that's needed.

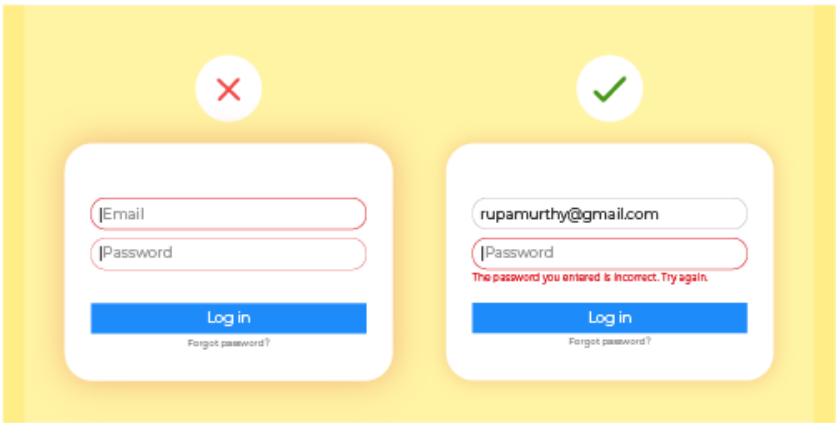


5. **Prevent errors:**

No one likes the feeling that they've done something wrong. Neither do your users.

There are two types of errors: slips and mistakes. Slips are unconscious errors caused by unattention. Mistakes are conscious errors based on a mismatch between the user's mental model and the design.

As much as possible, use user research to design the system so that the user cannot make a serious error. If an error is made, the system should be able to detect the error and offer a simple solution for handling the error.

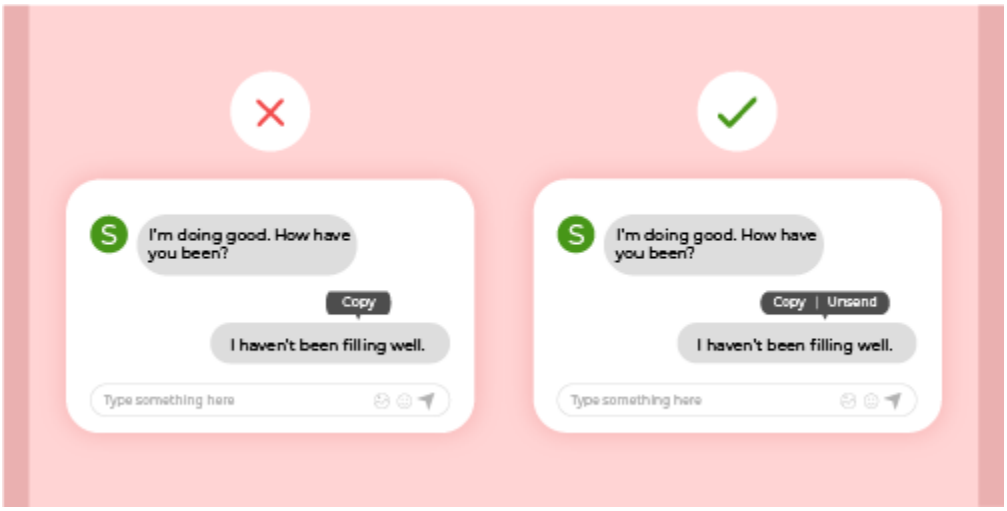


6. Permit Easy reversal of actions:

Shneiderman puts it eloquently "This feature relieves anxiety, since the user knows that errors can be undone; it thus encourages exploration of unfamiliar options."

In applications, this refers to the undo and redo functionality. Users often perform actions by mistake. They need a clearly marked "emergency exit" to leave the unwanted action without going through an extended process.

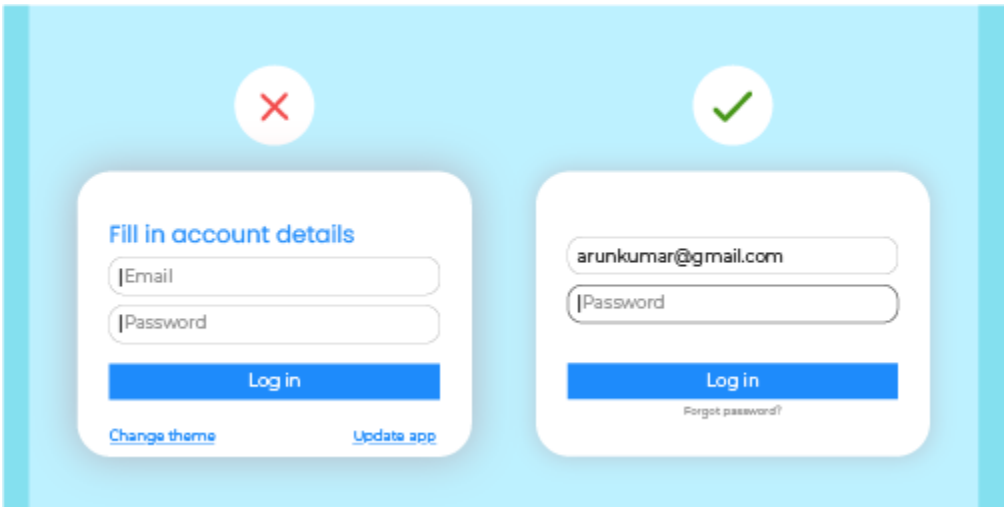
When it's easy for people to back out of a process or undo an action, it fosters a sense of freedom and confidence. Exits allow users to remain in control of the system and avoid getting stuck and feeling frustrated.



7. Internal locus of control:

Users strongly desire the sense that they are in charge of the interface and that the interface responds to their actions. They don't want surprises or changes in familiar behaviour, and they are annoyed by tedious data-entry sequences, difficulty in obtaining necessary information, and inability to produce their desired result.

Simplify interfaces by removing unnecessary elements or content that does not support user tasks.



8. **Reduce short term memory load:**

Recognizing something is easier than remembering it. Minimize the user's memory load by making objects, actions, and options available. The user should not have to remember information from one part of the dialogue to another. Instructions should be visible.

Humans have limited short-term memory. Interfaces that promote recognition reduce the amount of cognitive effort required from users and are thus more successful.

Q2. Explain Norman's 7 principles.

Ans.

1. Use both knowledge in world & knowledge in the head
2. Simplify task structures.
3. Make things visible.
4. Get the mapping right (User mental model = Conceptual model = Designed model).
5. Convert constrains into advantages (Physical constraints, Cultural constraints, Technological constraints).
6. Design for Error.
7. When all else fails – Standardize.

1. **Use both knowledge in world & knowledge in the head:**

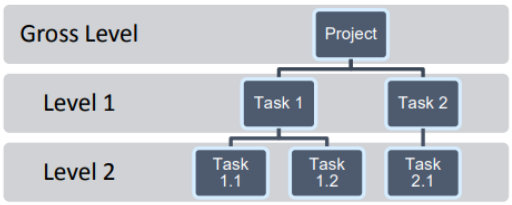
As a basis for his Interaction Model Norman proposed the following levels of abstraction of knowledge of the user :

- Task Level
- Goal Level
- Semantic Level
- Syntax Level
- Lexical Level
- Physical Level

The User models his/her knowledge in/of the world into his / mental realm by the process of cognation. The user's knowledge model is not necessarily the same as the knowledge model of the world.

2. **Simplify task structures:**

   Task level is to analyze the user's needs and to structure the task domain in such a way, that a computer system can play its part. The task level describes the structure of the tasks which can be delegated to the computer system.
   This principle states that a 'Task' is to be broken down (by analysis) to their simplest action level such that at each level there is as far as possible only one action involved.
   Doing so makes mapping with the Computer's programming langue easy for a HCI designer to build Interactive Interfaces & Hierarchies.



3. **Make things visible:**

   Objects at the Semantic level need to be mapped to the objects at Syntactic level, for the user. This is achieved with making the connection as 'Visual' as possible.
   Example: Windows, Icons, Menu Pointer.

4. **Get mapping right:**

   Mapping: the link between what user wants to do and what is perceived as possible - by the user based on the user's own logic.
   User Mental Model = Conceptual Model = Designed Model.

5. **Convert constraint into advantages:**

   This is about how to ensure that the user knows what to do next when there are more than one possibility or more than one given option.
   In other words how a designer needs to embed constraints in the sequence of operations in an interface such that the user is guided to the right sequence choice by reducing the chance of error in choosing the wrong option.
   As a principle Interfaces need to have any of the three type of constraints

   a) **Physical:**

      It is based on shape , size, area

   b) **Technological**:

      Closing a file without saving – user needs to be warned every time this is likely to be operated by the user. Program it such that it is mandatory to press the save button before close button.

      Culturally & semantically practiced rituals, symbols, color codes.

   c) **Cultural**:

      Closing a file without saving – user needs to be warned every time this is likely to be operated by the user. Program it such that it is mandatory to press the save button before close button.

6. **Design for errors:**

   Errors are not taken as human faults in users in HCI. This means Errors by users cannot be blamed on Users. Users are not the cause for errors. Often errors are 'slips' - intend to do one thing but end up doing another accidentally. Errors happen when there is a mismatch between User's mental model, designers' understanding of User's mental model; system limitations.
   Errors are classified as:

a. **Description Error:**
   Two objects physically alike are described / taken mistakenly for each other. One solution employed is ‘ highlighting’ the object which is in line of next action so that ‘ attention’ is drawn to that right object from amongst similar looking group of objects.
b. **Data Error:**
   Could be perception errors or selection errors. A solution could be reversal of action without penalty and ‘ affordance’ by the user to correct the error by retracing action steps.
c. **Associative action error:**
   Associative Errors are those that involve activating one sequence in place of another and realising it when the wrong /unexpected response results. Associative Errors also happen when short term memory is overloaded or long term memory fails. Forgetting to do something as prescribed or reversing the sequence.

7. **When all else is unsuitbles:**
   In certain situations / contexts wherein the nature of the task is critical , the user needs to be ‘ forced’ to follow a the only choice as given (afforded) by design.
   Example: Medical Devices; Warfare equipment; Nuclear Equipment; Power Plant Controls, Energy Grids; Air Traffic Controls etc.
   In such critical application context, standardization practice is followed.

Q3. Explain Universal Design principles.
Ans.

The process of designing product so that they can be used as many as possible in as many situation as possible.

Example: Age of footpath is load, Automatic doors, Both auditory and visual notification in lifts

❖ **Principles of Universal Design are as follows:**

1. **Equitable user:**
   - No user is excluded for all.
   - Whenever possible same access is granted for all.
   - Security safety provision is given to all.
2. **Flexibility in use:**
   Design should support adaption to range of abilities by choice of methods and adaptive to user space and customer.
3. **Simple to Use:**
   Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
4. **Perceptible Information:**
   The design should provide effective communication of information. Essential information should be emphasized and clearly from peripheral information.
5. **Tolerance of error:**
   The design must minimize the chance of error and minimize the error damage.
   Example: Product applying this principle is an educational software program

that provides guidance when the user makes an inappropriate selection.

6. **Low Physical effort:**
   Design can be used efficiently and comfortably. The doors that are easy to open by people with a wide variety of physical characterization demonstrate the application of this principle.
7. **Size and space for approach and use:**
   Appropriate size and space is provided for approach, reach, manipulation, and use regardless of users bodysize posture.
   A flexible science lab, a work area design for use by students with a wide variety of physical characterization and abilities.

Q4. Explain Multimodality interaction.

Ans.

Multimodality interaction provides the user with multiple modes of interacting with the system.

Multimodal is also called multi-sensor system.
Multimodal interaction in Human-Computer Interaction (HCI) refers to the use of multiple modes of communication and input/output channels to facilitate interaction between humans and computers. It enables users to engage with a computer system using various sensory modalities such as speech, touch, gestures, gaze, and even facial expressions. By combining and integrating these modalities, multimodal interaction aims to create a more natural, intuitive, and efficient user experience.

Here are some commonly used modalities in multimodal interaction:

1) **Speech:** Users can interact with the computer system through spoken language. Speech recognition technology enables the system to understand and interpret user commands or queries.
2) **Touch:** Touch-based input allows users to interact with graphical user interfaces (GUIs) through gestures, taps, swipes, or pinches on touchscreens or touch-sensitive surfaces.
3) **Gestures:** Users can employ hand movements, body postures, or specific gestures to convey commands or manipulate objects in the interface. Motion sensors or cameras can detect and interpret these gestures.
4) **Gaze:** Eye-tracking technology enables the system to track the user's eye movements and determine where they are looking on the screen.
5) **Facial Expressions:** Facial recognition technology enables the system to detect and interpret the user's facial expressions, which can be used to infer emotions or provide additional input for interaction.
6) **Haptic Interaction:** Haptic technology provides tactile feedback or the sense of touch to users. It can involve vibrations, force feedback, or pressure sensors that allow users to feel virtual objects or receive physical responses from devices.
7) **Context-awareness:** Multimodal systems can take advantage of contextual information, such as user location, environment, or previous interactions, to adapt and personalize the interaction. This helps in providing more relevant and tailored responses to the user's needs.

Multimodal interaction in HCI offers a more natural and expressive means of communication between humans and computers, enhancing the overall usability, accessibility, and user satisfaction in interactive systems.

Q5. Briefly Explain about all multimodal interaction.

Ans.

Same as Q.4)

Q6. How sound and touch are used in HCI?

Ans.

- **Sound:**

Sound is an important contributor to usability. Sound can convey transient information and does not take up screen space.

There are two types of sound:

a. Speech:

Speech recognition is the ability of a machine or program to identify words and phrases in spoken language and convert them to machine readable format.

The complexity of language is one barrier to success. Speech synthesis is complementary to speech recognition.

The notion of being able to convert naturally with computer is an appealing one for many users. Specially those who do not regard themselves.

Ex. Screen readers read the textual display to user.

b. Non-Speech sound:

Non -Speech sound can be used in number of ways in interactive system. It is often used to provide transitory information such as indication of network or system changes or of errors.

Commonly used for warnings and alarms.

Evidence to show they are useful:

- Simple error sound in Windows.
- Low battery.

They are language independent, Unlike speech.

This is useful for visually impaired persons.

- **TOUCH:**
  The use of touch in interface is known as Haptic Interaction.
  It can be roughly divided into two areas:

a.Cutaneous perception:

It is the physical touch, vibration on the skin.

b. Kinestics perception:

Body movement and position.

Example technologies:

- Electronic braille display (for blind people).
- Force feedback devices like mic,etc.

Q7. Explain type of disability and how HCI is helpful for disable people.

Ans.

1. **Visual Disability:**
   It is not just about blindness, visual disability also contain color issues, limitations. Mostly visual disability occurs in aged group of person.

- **Solution:**

a.Screen readers: Screen readers are software applications that read out the text displayed on a computer screen or mobile device. Screen readers enable people with visual disability to access and navigate digital content, including websites, applications, and documents.

b. Keyboard navigation: Many individuals with visual impairments rely on keyboard navigation rather than a mouse or touch input. Designing interfaces that can be easily navigated using keyboard shortcuts and tab-based navigation improves accessibility.

2. **Hearing Disability:**
   It can be from birth or due to environment and noise issues.

- **Solutions:**

a. **Closed Captioning and Subtitles:** Providing accurate closed captioning or subtitles for audio content is essential for individuals with hearing disabilities. This solution allows them to read the dialogue or narration, making video content, online courses, and multimedia presentations accessible.
b. **Visual Cues and Alerts**: Since individuals with hearing disabilities rely heavily on visual information, HCI systems can use visual alerts, and notifications to convey important auditory information.

3. **Physical disability:**
   It can be wide range, limited range, or an injury.

- **Solutions:**
  a. **Gesture**: HCI research has explored the use of gesture recognition and motion

tracking technologies to provide alternative means of interaction for individuals with physical disabilities.

b. **Speech Input:** Speech recognition technology allows users to input commands and control devices using spoken language. The system analyzes the user's voice and converts it into text or performs actions based on the recognized speech.
c. **Eyegaze Solution:** Eye gaze technology tracks the movement of a user's eyes and translates it into input commands for a computer or device.

4. **Speech disability:**

It can be Permanent, temporary,etc.

- **Solutions:**

a. **Gesture and Body Language Recognition**: HCI solutions incorporate gesture and body language recognition technologies, such as depth cameras or wearable sensors, to interpret non-verbal hints and translate them into computer commands.
b. **Text Communication:** Speech disabilities can pose significant challenges for individuals in expressing themselves and communicating effectively. Fortunately, text communication offers a viable solution for those with speech disabilities, enabling them to communicate their thoughts, needs, and emotions through written text.

5. **Aged Groups:**

Addressing the challenges and disabilities faced by the aged group in the field of Human-Computer Interaction (HCI) requires a comprehensive and inclusive approach.

- **Solutions:**

a. **Clear and Simple Interface Design:** Older adults may experience cognitive and visual impairments, making it crucial to design interfaces that are clear, simple, and free from clutter. Using legible fonts, well-contrasted colors, and intuitive icons can enhance readability and reduce cognitive load.
b. **Customizable Preferences:** Offering customization options within HCI interfaces allows older adults to personalize their user experience based on their specific abilities and preferences. This may include adjustable font sizes, color schemes, or audio hints to accommodate varying levels of visual impairment.

Q8. Why cultural differences are consider in diversity?

Ans.

It is due to influence of nationality, generation, gender, class, religion, and political influence.

HCI aims to design and develop technology that is usable, accessible, and inclusive for people from diverse backgrounds, including different cultures.

Ex.

- Interpretation and acceptability of languages, Cultural symbols and gestures and colors.
- Having trouble in small prints.
- The problem of lefty.
- Chair that child cant seat properly.

In our interconnected world, technology is used by people from various cultures and regions. Considering cultural differences in HCI is crucial for designing technology that can be effectively used and localized for different markets.

Incorporating cultural differences in HCI acknowledges the importance of designing technology that is inclusive, accessible, and relevant to diverse users. By considering cultural distinctions, HCI practitioners can create more effective and user-friendly technology experiences that accommodate the needs and preferences of people from different cultural backgrounds.

HCI Assignment No. 6

Q1.What is groupware?

Ans.

Groupware refers to software applications that facilitate collaboration and communication among individuals or groups working together on shared tasks or projects. It enables multiple users to interact, share information, coordinate activities, and collaborate in real-time or asynchronously, regardless of their physical locations. Groupware typically includes features such as document sharing, messaging, scheduling, task management, and shared workspaces, allowing teams to work more effectively and efficiently.

Groupware makes the user aware that he is part of a group, while most other software seeks to hide and protect users from each other.

Groupware supports the coordination of tasks and activities within a group. It allows users to create and manage shared calendars, schedules, and to-do lists, ensuring that everyone is aware of important deadlines, meetings, and responsibilities.

- **Why Groupware is becoming important?**
  - Forms groups with common interest.
  - Better customer service.
  - Cut down travel cost, time.
  - Facilitate group problem solving.
- **Need of Groupware:**
  - Increase interaction among people, not between computers, and people.
  - We have to understand group processes.
  - It accommodates various forms of collaboration, including synchronous and asynchronous interactions.
  - It help manage the vast amount of information generated during collaborative work.

Q2. Explain time/space matrix with example.

Ans.

In the context of Human Computer Interaction (HCI), Time/Space matrix refers to a conceptual framework that helps understand where and when the participants are performing the cooperative work.

Time/Space matrix classifies groupware by time and space dimension:

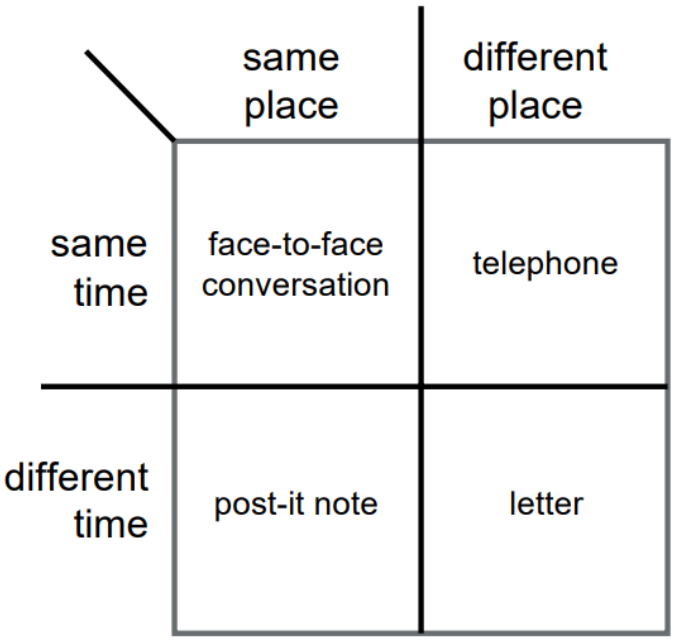
Time Dimension contains: when the participants are working, at the same **time** or not.

Space Dimension contains: where the participants are working, at the same place or not.

Common names for axis are:

time: synchronous/ asynchronous.

place: co-located/remote.



Examples:

1. **Same time same place:**
   Designers working together in a design studio: They are all present in the same physical space, sitting around a table, and collaborating on a project. They can directly communicate with each other, share physical artifacts, and provide instant feedback.

2. **Same time different place:**
   A virtual team meeting: Let's say a team of professionals from different cities needs to discuss and work on a project together. They can use groupware tools and technologies such as video conferencing software, collaborative document editing platforms, and instant messaging applications to communicate and collaborate in real time.

3. **Different time same place:**

A team of designers working on a project: They gather in a meeting room, each equipped with a device such as a tablet or a laptop. Using groupwarenthey access a shared digital whiteboard or document. The team members can contribute ideas, sketches, or annotations on the shared space, even if they are not doing so simultaneously. They can leave comments, make edits, or add content at different times, leveraging the advantages of asynchronous collaboration.

4. **Different time Different place:**

Letters: In a different time and place, a letter in the Time-Space Matrix groupware system would enable users to communicate across different temporal and spatial dimensions. Users could write and send letters that would traverse temporal boundaries, enabling communication with individuals from the past or future, as well as across different physical locations.

Q3. Explain email and Bulletin board in details.

Ans.

Both email and bulletin boards are of asynchronous type.

They are familiar and most successful groupware.

Many people may have used email and bulletin boards.

- **Email:**
  Email stands for "electronic mail," and it is a method of sending and receiving digital messages over the internet or a computer network. It is one of the most widely used forms of communication in both personal and professional settings. Email allows individuals to exchange messages with one another quickly, efficiently, and securely.

  Consider stages of sending email message:

  1. You type a message at your computer, possibly adding a subject header.
  2. You then instruct the email program to send it to recipient.
  3. After some time, it will arrive at the recipient's computer.
  4. If the recipient is using computer a message will be displayed saying mail has arrived.
  5. The recipient reads the message using email program.

- **Bulletin Boards:**
  A bulletin board, often referred to as a BBS (Bulletin Board System), is a computer-based platform that allows users to exchange messages, share information, and engage in discussions. Bulletin boards were popular in the early days of the internet and predate the modern web-based seminars and social media platforms.

Q4. What is communication through artifact?

Ans.

Communication through artifacts in HCI refers to the exchange of information, meaning, and intentions between users and technology using physical or digital objects or elements within the user interface. These artifacts are designed to facilitate effective and efficient communication between humans and computer systems.

The awareness of each others action is a form of Communication through artifacts.

Some aspects of communication through artifacts are:

1. **Visual Representation:** Artifacts in HCI often employ visual elements to convey information. This includes icons, images, text, colors, and other visual cues. Visual representations can communicate various aspects such as the system state, available actions, and feedback on user interactions. For example, a progress bar visually communicates the status of a task.
2. **Interaction Design:** Artifacts play a crucial role in interaction design by providing interactive elements that enable users to communicate with the system. These can include buttons, checkboxes, sliders, dropdown menus, and other interactive components.

Communication through artifacts in HCI focuses on designing interfaces and interactions that effectively convey information, facilitate user understanding, and enable seamless communication between users and technology.

Q5. Identify three types of shared applications and explain about them.

Ans.

1. **Shared PC and shared windows system:**

A shared PC refers to a computer system that is used by multiple individuals or users. Instead of each person having their own dedicated computer, they share the same machine. In a shared PC environment, each user typically has their own user account with separate settings, preferences, and files. This allows multiple people to use the same computer while maintaining their individualized experiences.

A shared window system involves a graphical user interface (GUI) where multiple users can simultaneously view and interact with different windows or applications on a shared display. This enables collaboration and multitasking among users. Each user can have their own set of windows, and they can arrange, resize, and interact with their windows independently or in coordination with others.

2. **Shared Editors:**

Shared editors in HCI (Human-Computer Interaction) refer to collaborative editing systems that allow multiple users to simultaneously edit a document or work on a shared task. These editors enable real-time collaboration and communication among users. The primary goal of shared editors is to enable multiple users to work

together on the same document or project, regardless of their physical location. Users can see each other's edits in real-time.

3. **Shared diaries:**

Shared diaries in HCI (Human-Computer Interaction) refer to collaborative platforms that enable multiple users to interact, contribute, and share their personal thoughts, experiences, or reflections in a diary-like format. These platforms promote collective storytelling, information sharing, and social connections among users. Shared diaries can be used in various contexts, such as group projects, therapy sessions, or online communities, enhancing communication within a shared digital space. The design of shared diaries often focuses on privacy controls, access management.

Q6. How do you think groupware is likely affect our lives in future? Justify with example.

Ans.

Groupware, which refers to software applications that facilitate collaboration and communication among individuals working in groups, is likely to have a significant impact on our lives in the future. With advancements in technology, groupware will play a crucial role in enhancing productivity, enabling efficient teamwork, and fostering innovation. Here's a justified example of how groupware can affect our lives in the future:

Imagine a group of researchers from different countries working on a scientific project. In the past, they would have faced numerous challenges such as preparing schedules, sharing large volumes of data. However, with the advancements in groupware, they can now utilize powerful collaborative tools to streamline their work processes.

For instance, they can use cloud-based document sharing platforms to edit and collaborate on research papers simultaneously, allowing for real-time contributions and feedback. Virtual meeting platforms with advanced video and audio capabilities enable face-to-face discussions, eliminating the need for extensive travel.

The impact of groupware goes beyond the research field. It can revolutionize various domains such as education, business, and healthcare.

Groupware is likely to have a transformative effect on our lives in the future by enabling efficient collaboration and breaking down barriers of distance and time. It will facilitate global teamwork, encourage innovation, and empower individuals and organizations to achieve more together.

Q7. Distinguish between direct and indirect communication.

Ans.

Direct Communication	**Indirect Communication**
Immediate and explicit exchange of information.	Non-Immediate exchange of information.
Real-time interaction	Delayed interaction
Ex. Face-to-face conversation	Ex. Email, text messaging
Instant feedback	Delayed feedback
Contextually rich	Context may be lost or limited
Presence of nonverbal hint (e.g., body language)	Nonverbal hints may be absent or limited
It is synchronous	It is asynchronous
No	Yes
Lower complexity	Higher complexity
Direct observation of emotional hint	Emotional hints may be missed or misinterpreted
High Bandwidth	Low bandwidth

Q8. Why argumentation tools are important?

Ans.

Argumentation tools are important in Human-Computer Interaction (HCI) for several reasons:

1. **Decision-making:** HCI often involves making decisions regarding interface design, system behavior. Argumentation tools provide a structured framework for presenting and evaluating different arguments, allowing designers, developers, and stakeholders to make informed decisions.
2. **Collaboration:** Argumentation tools facilitate collaboration by enabling stakeholders to express their viewpoints, engage in constructive debates, through reasoned arguments. This promotes a more participatory design process.
3. **Evaluation:** Argumentation tools help in analyzing design choices by providing a systematic approach for identifying strengths, weaknesses. They allow researchers to justify their evaluations and support their findings with sound reasoning.
4. **Communication:** Effective communication is crucial in HCI to convey design intentions, user needs. Argumentation tools assist in structuring and presenting arguments in a clear manner. They enable designers to explain their design choices, assume potential concerns, and engage in meaningful discussions with users and stakeholders.

Argumentation tools play a vital role in HCI by supporting decision-making, facilitating collaboration, enabling evaluation, enhancing communication. They promote a more robust, evidence-based approach to designing and evaluating interactive systems.