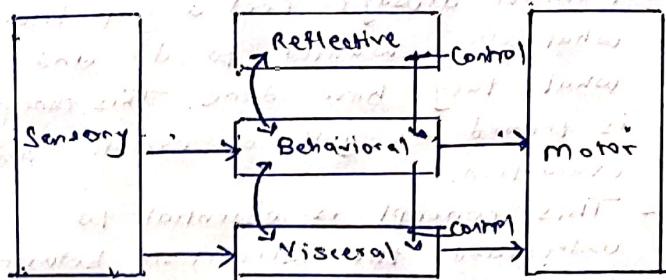


Module 1 - Human-Computer Interaction - Foundations of HMI - In short

Seven stages of action

- As per Norman, human actions will have two basic aspects:
 - ① Execution
 - ② Evaluation
- The task performed by human is referred as action (execution).
- Once task is performed that must be analyzed for improvement (evaluation).
- Stages of action:
 - a. Stage 1: Setting goal of action.
 - b. Stage 2: Set up plan of action.
 - c. Stage 3: Specifying an action to be performed.
 - d. Stage 4: Performing the action
 - e. Stage 5: Identify the state of external world
 - f. Stage 6: Interpreting the state of external world
 - g. Stage 7: Evaluation of action output by comparison with other actions.
- The procedure of the above 7 stages look very easy but need to be done systematically.
- Example:
"I am reading a book and decide to need more light".
- Now, look at the action of human brain.
- ① Goal : Get more light.
- ② Plan : Push the switch button of the lamp.
- ③ Specify : (mental event) move my body, reach the switch, extend my fingers.
- ④ Perform : (Physical event) Action executed.
- ⑤ Perceive : There is more light in room
- ⑥ Reflect : Whether there is need of lamp.
- ⑦ Compare : Whether the resulting amount of light is sufficient.

Three levels of processing



Processing Levels

- The processing can be done in 3 steps.
- End users can share experiences by designing models and convert them into prototypes for development.

① Level 1: Visceral level

- Initial level of processing available information
- This level of design refers to the perceptible qualities of the object and how they make the user/observer feel.
- The external look and touch of the product will dominate the user at visceral level.
- This design often refers to creating the best user interface and graphical appearance.
- Once this level is approved we can proceed toward actual work.
- If this level is not designed properly other levels will need more efforts for product acceptance.

② Level 2: Behavioral level

- It is the more detailed level of product description than visceral.
- This level essentially refers to the emotions we feel as a result of either accomplishing or failing to complete our goals.
- In this level, semantic and usability practices are addressed and help decide behavior and feedback of product.
- Example, a dialog box with an error message informs the user about the next step of action.
- ON and OFF on electric switch can simply explain its operation.

③ Level 3: Reflective level

- The final level of processing is analysis and reflection of all experiences is done in this level.
- This level mainly deals with analyzing past experiences and future requirements to plan for goals.
- Then based on user preferences, we choose a method to execute plan.

Gulf's of Execution and Evaluation.

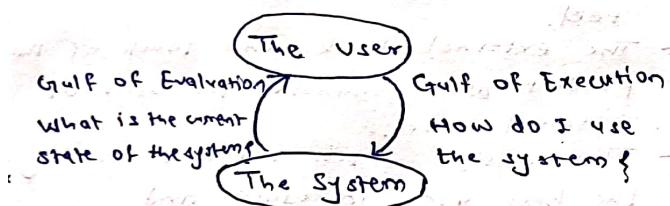
- Human always feel a gap between what they wanted to do and what they have done. This concept is termed as gulf of execution and evaluation.

- This concept is essential to understand the interaction between humans and computers.

- **Execution:** Taking action to accomplish a specific goal

- **Evaluation:** Understanding the state of the system.

- The gulf of execution and the gulf of evaluation describe two major challenges that users must overcome to successfully interact with any device.



1. Gulf of Execution (bridge)

- It is the degree of ease with which a user can understand the current state of a system.

- It is the difference between the intentions of the user and what the system allows them to do.

- Example, a person can look at a light switch and easily identify what the current state of the system is (i.e. whether light is on/off) and how to operate the switch.

This means gulf of execution is small. As per Norman, for best design, interface, the gulf must be kept as small as possible.

2. Gulf of Evaluation

- It is a degree of ease with which a user can perceive and interpret whether or not the action they performed was successful.

- This gulf is small when the system provides information about its state in a form that is easy to receive, interpret and matches the way user thinks of a system.

- Example, light switch; if a person looks at a light switch, the gulf of evaluation is very small since with one switch user will immediately know if their action was successful.

Example, if a user pushes a button on a computer keyboard, the gulf of evaluation is large.

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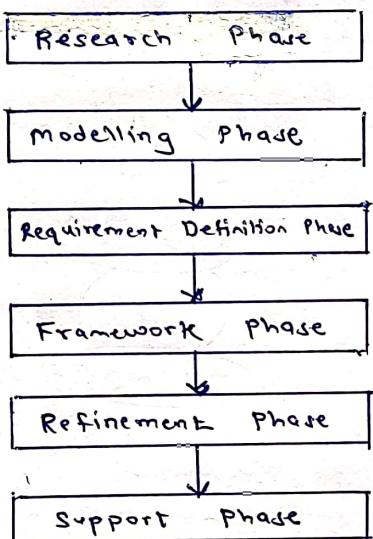
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Design and Software Process

Goal - directed design process

- Goal - directed design combines techniques of ethnography, stakeholder interviews, market research, product/literature reviews, detailed user models, scenario-based design and a core set of interaction principles and patterns.
- It provides solution that meet the needs and goals of users while also addressing business/organizational and technical imperatives.



Goal - directed design process

① Research Phase

- This phase will help understand the gap between user and developer.
- It focuses on market survey, conducting user interviews and user observation.
- It will generate actual user information.
- It will help to identify behavior patterns of various users and modelling phase.

② Modelling Phase.

- Output of research phase is converted to user model.
- User model includes information flow and workflow.
- This phase will help understand user.

③ Requirement Definition Phase

- This phase provides the needed connectivity between user, models and product framework.
- It is important phase as it gathers requirements.

④ Framework Phase

- This phase will present the actual product design and framework for the system behaviour.
- It also propose product interaction framework.
- It also explains colour schemes and visual styles' of the users expectations.

⑤ Refinement Phase

- It mainly emphasizes on the details of the system and product implementation.
- It helps create storyboard at a very high level of detail.

⑥ Support Phase

- This phase tries to meet all future requirements.
- Application and design level support is provided
- This phase will perform User Acceptance Testing (UAT) to make sure all developmental goals are fulfilled.

Module 3 Graphical User Interface

Principles of User Interface Design

- User Interface provides communication between users and devices. It is not only about arranging buttons, picking colours, selecting menu but also choosing the right tool to provide effective interaction.
- The principles of User Interface design are intended to improve the quality of user interface design.

① Familiarity

- The interface should use terms and concepts which are drawn from experienced users to make system more usable.
- Usability is often related with familiarity of users using interaction styles.
- Example, If a user is habitual to a windows OS, it would be a bit difficult for him to work on macOS in first interaction.

② Consistency

- The interface should be consistent across the application.
- Consistency allows users to recognize usage patterns.
- Once user learns about the certain parts of the interface working, the same knowledge can be applied to new areas and features.
- Example, Tool bar interface is consistent in ms applications. (i.e. Microsoft Word, Excel, powerpoint)

③ Minimal surprise

- Users should never be surprised while performing any action on the system.
- The user should be able to predict the operation of the commands.
- Example, Recognition of Button.

View Order ← Simple text

View Order ← Button

④ Recoverability

- The system should provide some resilience to user error and allow the user to recover from errors.
- This might include an undo facility.
- Confirmation of destructive actions.
- The interface has to be able to help its users to recover from their mistakes.
- Example, The dialog box for the confirmation of action to perform.

⑤ User Guidance

- The interface should not mislead users and must provide meaningful feedback.
- Interface should provide guidance to users for full usage of applications.
- Ensuring the user is aware of what's going on and there is a help option available if they need any help to perform any task.
- Example, Get help option is available in dialog box.

⑥ User Diversity

- Interfaces should be designed in such a way that different types of users can use it.
- Interface designing is not only for users of all ages but all genders, levels of impairment, culture and ethnicity.

Content	Graphical User Interface	Web Page Design
User Focus	Data and Application	Information and Navigation
User Tasks	Install, configure, personalize, start, use, use, upgrade, programs	Link to a site, browse, or read pages, fill out forms, register for services, etc.
Task Efficiency	Targeted to a specific audience with specific tasks.	Often intended for anyone and everyone
User Conceptual Space	Controlled and constrained by program logic	Infinite and generally unorganized
Context	Sense of context is neatly manipulated	Sense of context is poorly manipulated
Hardware Variation	Limited	Enormous variation
Presentation Element	Windows, menus, controls, data, toolbars, etc.	Two components - browser and page
Navigation	Through menus, lists, trees, dialogs and wizards	Through links, bookmarks - and typed URLs
Interaction	Interaction such as clicking menus/choices, pressing buttons, selecting list choices.	Basic interaction is a single click.
Response Time	Nearly instantaneous	Variable depending upon transmission speed, page content.

Module 4

Screen Designing

Statistical Graphics

- Graphical representation of data gives a clear picture, presenting numbers in an ordered way.
- It helps us to avoid the data distortion and gives clear purpose of description, exploration, tabulation.
- It is used to minimize redundant data.
- It shows the variation of data in a single space.
- It helps comparing actual data and projected data.
- It provides meaningful organization of data in different formats.

Types of statistical graphics.

① Curve and Line Graphs:

- Curve and Line graphs can be used to show relationships between sets of data defined by two continuous variables.
- They are especially useful for showing data changes over time.
- With a curve, the data relations are summarized by a smoothed line.
- With a line, straight line segments connect the data points.

② Pie Charts:

- A pie chart is a circular statistical graphic.
- It is divided into slices to illustrate numerical proportion.
- In a pie chart, the arc length of each slice is proportional to the quantity it represents.
- Pie charts are very widely used in the business world and the mass media.
- Pie charts should be used with captions.

③ Scatter plots

- A scatter (XY) plot has points that show the relationship between two sets of data.
- A scatter plot / scatter graph is a type of mathematical diagram using cartesian coordinates to display values for two variables for a set of data points.
- The data is displayed as a collection of points, each having the value of one variable determining the position on the horizontal axis and the value of the other variable determining the position on the vertical axis.

④ Bar Graphs:

- A bar graph is a graphical display of data using bars of different heights.
- The bars can be plotted vertically or horizontally.
- A vertical bar chart is sometimes called a column bar chart.
- A bar graph is a chart that uses either horizontal or vertical bars to show comparison among categories.
- One axis of the chart shows the specific categories being compared and the other axis represents a discrete value.
- It is necessary to keep space between bars equal to one half the width of the bars or less.

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.
- Clarity is influenced by a multitude of factors:
 - ① Consistency in design
 - ② Visually pleasing composition
 - ③ Logical and sequential ordering and grouping.
- It includes consistency such as provide real world consistency and internal consistency.

Ordering of Screen data and content

- Ordering of screen can be considered as dividing information into units that are logical, meaningful and sensible.
- It should be organized by the degree of interrelationships between data or information.
- It should provide an ordering of screen units of elements depending on priority.
- It ensures that information is visible.
- It consists of form groups that cover all possibilities.
- Possible ordering schemes include:
 - ① Conventional
 - ② Sequence of use
 - ③ Frequency of use
 - ④ Function
 - ⑤ Importance
 - ⑥ General to specific

Module 5

Interface Design for Mobile Device

Mobile 2.0

- The term is derived following the same principles of Web 2.0.
- Mobile 2.0 has made many things possible which earlier were not possible! Users can connect not only with voice but also control various devices online.
- The web is transformed into more agile and user focused medium which can easily deliver information to masses.
- Social media connectivity has become easier due to Mobile 2.0.
- Users can share personalized content on mobile and web.
- Access have become easier, i.e. just a touch away.
- Wireless connectivity has improved significantly. i.e. things like texting, listening, capturing, etc has become easier.
- Multimedia content is rich like never before.
- Characteristics of mobile 2.0.
 - ① Social networking has become easier.
 - ② The users are generator of the content, and the website is run by the content creators, users, etc.
 - ③ Syncing various platforms, applications and devices to supply a very immersive and rich user experience.
 - ④ Always available and always connected

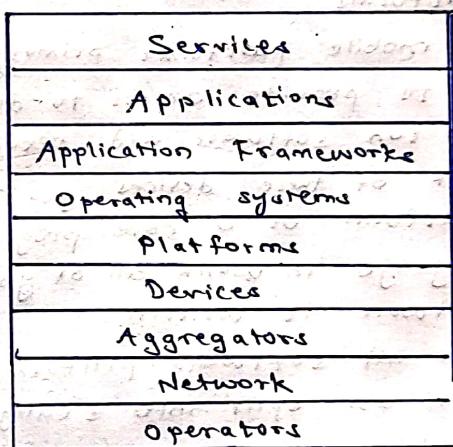
Seven Principles of mobile 2.0.

- ① The web as a platform
- ② Harnessing collective intelligence
- ③ Data is the next intel inside
- ④ End of the software release cycle
- ⑤ Lightweight programming models
- ⑥ Software above the level of single device
- ⑦ Rich user experience

Mobile Ecosystem

- It is a collection of multiple devices, softwares, companies, etc and process by which data is shared by a user from one device to another device or by the device itself based on some programs.
- Data sharing can be done among devices of the same operating systems or different operating systems.
- Data can be also shared among multiple devices with the same operating system.
Eg., Apple Ecosystem.

Mobile Ecosystem Layers



① Operator

- Base layer in mobile ecosystem.
- Operators can be referred to as Mobile Network Operators (MNOs).
- Operators are what essentially make the entire mobile ecosystem work.
- They are the gatekeeper's to kingdom
- The operators role in the ecosystem is to create and maintain a specific set of wireless services over a reliable cellular network.

② Network

- Operators operate wireless networks.
- Remember that cellular technology is just a radio that receives a signal from antenna.
- The type of radio and antenna determines the capability of the network and the services you can enable on it.
- Majority of networks use GSM standard, GPRS or EDGE for 2G and UMTS for 3G.

- ③ Aggregators
- Also known as mobile enablers.
 - Third-party companies that bridge the gap between content owners, operators and consumers.
 - They are necessary middleman with untapped experience and knowledge that can't be overlooked or undervalued.

- ④ Devices
- Devices in mobile industry are considered as handsets and terminals.
 - These are terms that are becoming outdated with the emergence of wireless devices that rely on operator networks but do not make phone calls.

- ⑤ Platforms
- A mobile platform's primary aim is to provide access to devices.
 - To run software and service on each of these devices, you need a platform or a core programming language in which all of your software is written.
 - Like all software platforms, these are split into 3 categories:
 - ① Licensed.
 - ② Proprietary
 - ③ Open source

- ⑥ Operating systems
- It is important component of mobile which operates all applications that are residing on mobile phone.
 - Android is open source and iOS is closed source.
 - Examples, iOS, Android, Blackberry OS.

- ⑦ Application Frameworks
- It often runs on the top of OS, sharing core services such as communications, messaging, graphics, location, security, authentication and many other.
 - It is used to create applications such as a game, web browser, camera, media player, etc.

- ⑧ Applications
- It is a computer program that runs on a website/mobile (Google App), a small computing devices (iPad App) or a cell phone (Android App).
 - Application is a point of interaction between device and the user.
- ⑨ Services
- Services are everything the user is trying to do.
 - They are often available at different levels such as application, application framework and operating system.
 - Examples:
 - ① Internet
 - ② sending a text message.

Module 6

Interaction styles and communication

Types of Windows

① Primary Window

- It is the first window which appears on the screen when activity or action is started.
- Primary window represents an independent function or application.
- It is used to present information that is continually updated.
Example, Date and Time.

② Secondary Window

- Secondary windows are supplementary windows.
- It may be dependent upon a primary window or displayed independently of the primary window.
- Secondary windows are used to performing subordinate, supplementary or ancillary actions.

③ Dialog Boxes

- It is used for presenting brief messages.
- It includes command buttons such as OK, Cancel, save, etc.
- It is used to perform actions that take short time to complete and are not frequently changed.

④ Message Boxes

- It is used to display a message about a particular situation.
- It includes command buttons such as OK, Cancel, Help, Yes, No, etc.

⑤ Palette Windows

- It is used to present a set of controls.
 - It is designed as resizable.
- Alternately, design them as fixed in size.

⑥ Pop Up Window

- It is used to display additional information.
- It is also used to display context sensitive help information.
- It displays textual labels for graphic control.

Window Presentation style

The presentation style of a window refers to its spatial relationship to other windows.

① Tiled Windows

- Tiled windows derive their name from wall tile.
- Tiled windows appear in one plane on the screen and expand or contract to fill up the display surface, as needed.
- Most systems provide two-dimensional tiled windows, adjustable in both height and width.

Advantages

- Windows are repositioned automatically, so there is no need for the user to decide on positioning.
- Open windows are always visible.
- Every window is always completely visible, eliminating the possibility of information being hidden.

Disadvantages

- Only a limited number of windows can be displayed.
- As windows are opened/closed, existing windows change in size.
- As the number of displayed windows increased, each window can get tiny.

② Overlapping Windows

- Overlapping windows may be placed on top of one another like papers on a desk.
- They possess a 3-dimensional quality appearing to lie on different planes.
- Size of overlapping windows can be altered.
- Location as well as the plane of the windows is user controlled.

Advantages

- Greater control allows the user to organize the windows to meet his/her needs.
- Windows can maintain large sizes.
- Windows can maintain consistent size.
- Windows can maintain consistent positions.

Disadvantages

- They are complex to operate than tiled windows.
- More control function requires greater user attention.
- Windows themselves can be lost behind other windows.
- Control freedom increases the possibility of crowding.
- Too many windows can be visually overwhelming.

③ Cascading Windows

- It is a special type of overlapping window.
 - It has the windows automatically arranged in a regular progression.
 - Each window is slightly offset from other.
- Advantages**
- No window is ever completely hidden.
 - Bringing any window to the front is easier.
 - It provides simplicity in visual presentation and cleanliness.

Importance of Text Messages with respect to communication with user

Text message:

- Text-based communication is a dominant form of direct communication.
- Text messages are communicated provided on the screen to the user.
- Screen messages fall into two broad categories:

① Instructional messages:

- Tell the user how to work with, or complete, the screen displayed.

② System messages

- Generated by the system to keep the user informed of the system's state and activities.

Types of system messages

① Status message

- It provides information regarding the progress of lengthy operation.
- It usually contains a progress indicator and a short message.

② Informational messages

- Also known as notification message.
- This kind of message is usually identified by an "i" icon to the left of the message.
- It is used to provide the information about the state of system.

③ Warning messages

- They are usually identified by an "!" icon to the left of the message.
- The user must determine whether the situation is in fact a problem and may be asked to advise the system whether or not to proceed.

④ Critical messages

- Also known as Action messages.
- A message describing an erroneous situation is usually presented as a critical message.
- It requires user action to proceed.

⑤ Question messages

- Question message asks a question and offers a choice of options for selection.
- It is designated by a "?" icon preceding the message text.

Importance of text message:

- Wording of the interface and its screens is the basic form of communication with the user.
- Clear text message minimize the user confusion that leads to errors.
- Do not use technical words, made-up words.
- Do not use abbreviations/acronyms.

Sentences & message:

- Brief and simple
- Directly and immediately readable

ICONS

- Icons is picture that represents an object or program.
- An icon is a graphical representation of a program or file that when clicked on will be run or opened.
- Icons are used with Graphical User Interface (GUI) OS.
- GUI operating system includes Microsoft windows and Apple Mac OS., etc.
- Example, My Computer icon in Microsoft Windows.

Advantages.

- It helps to add a creative touch to the website or application.
- Icons can communicate an idea in seconds.

Influence of Icons

- provide icons that are
 - ① Familiar
 - ② Simple
 - ③ Consistent
 - ④ Efficient
 - ⑤ Clarity
 - ⑥ Directness of the meaning
 - ⑦ Discriminable from others

Guidelines for color selection for web pages

- Always use minimum colors for faster downloading
- Always consider color in overall context and never in isolation.
- Using similar or same color schemes throughout a website help the user maintain a sense of place.
- Background and foreground colors should be different.
- Black color is the most recommended foreground text color.
- Dark backgrounds are used when establishing contrast between an area of the screen and the main screen body
- High intensity colors in background must be avoided.
- Uniform color should be used in large screen areas.
- Large areas of the same color can download faster.
- Contrast can be used for smaller elements.