**HCI Unit 2**

1. Human Memory Model

*S****ensory Memory:****The initial stage where information from the environment is briefly registered in sensory systems (e.g., visual or auditory stimuli). It provides a brief buffer that allows the perception of the world to be continuous.*

***Short-term Memory (STM) or Working Memory:****Information that is consciously processed and temporarily held in the mind. Working memory is limited in capacity and duration, typically holding information for a few seconds to a minute. In HCI, this is essential for tasks requiring immediate attention and processing.*

***Long-term Memory (LTM):****The repository of information that is more permanently stored. Information from short-term memory is transferred to long-term memory through processes like rehearsal and elaboration. In the context of HCI, designing interfaces that facilitate the transfer of information from working memory to long-term memory is important for users to remember how to use the system effectively over time.*

A diagram of a short-term memory

Description automatically generated

1. STM vs LTM

|  |  |  |
| --- | --- | --- |
| **Feature** | **Short-Term Memory (STM)** | **Long-Term Memory (LTM)** |
| **Capacity** | Limited (approximately 7 ± 2 items) | Virtually unlimited |
| **Duration** | Brief (a few seconds to a minute) | Long-lasting (minutes to a lifetime) |
| **Access Time** | Fast | Slower compared to STM |
| **Forgetting** | Quick, due to decay or displacement | Slower, due to decay, interference, or retrieval failure |
| **Nature of Information** | Typically auditory or visual, often unprocessed | Includes declarative (facts, events), procedural (skills), and episodic (personal experiences) |
| **Mechanisms of Forgetting** | Decay, proactive interference | Decay, retroactive interference, lack of retrieval cues |
| **Examples** | - Remembering a phone number briefly  - Holding a grocery list in mind  - Recalling words in a sentence while reading | - Recalling childhood memories  - Remembering how to ride a bike  - Knowledge of historical facts |

1. Wimp interface

A **WIMP interface** is a type of graphical user interface (GUI) that stands for **Windows, Icons, Menus, and Pointers**. It is a standard interface model used in most desktop operating systems and applications. The WIMP paradigm has been fundamental in making computers more accessible and user-friendly, allowing users to interact with digital environments intuitively.

**Components of a WIMP Interface**

1. **Windows:**
   * **Definition:** Rectangular areas of the screen that display content from different applications or documents.
   * **Functionality:** Windows allow users to view multiple applications simultaneously, each in its own isolated space. They can be moved, resized, minimized, maximized, or closed, offering flexibility in managing tasks.
   * **Design Use:** Ensure windows are resizable and movable, provide clear buttons for minimizing, maximizing, and closing, and maintain consistent window behavior across applications.
2. **Icons:**
   * **Definition:** Small graphical representations of files, applications, functions, or commands.
   * **Functionality:** Icons provide a quick and easy way to recognize and access resources and commands without needing text-based descriptions.
   * **Design Use:** Use clear, easily recognizable icons that visually convey their purpose. Group related icons logically, and provide tooltips or labels for additional clarity.
3. **Menus:**
   * **Definition:** Lists of options or commands that can be selected by the user.
   * **Functionality:** Menus allow users to access application features and functions in a structured manner. They can be pull-down menus, context menus (right-click), or pop-up menus.
   * **Design Use:** Organize menus logically, group related functions together, and use familiar terminology. Ensure menus are easily accessible and provide keyboard shortcuts for power users.
4. **Pointers:**
   * **Definition:** A cursor or indicator controlled by a pointing device (e.g., mouse, trackpad) used to interact with elements on the screen.
   * **Functionality:** The pointer allows users to navigate the screen, select objects, and execute commands by clicking or dragging.
   * **Design Use:** Ensure the pointer is visible and its shape changes contextually (e.g., from an arrow to a hand or a text cursor) to provide feedback on possible actions. Optimize the interface for various pointer devices.

**Example of a WIMP Interface in Use**

Consider designing a **file management application** using the WIMP interface model:

* **Windows:** Each open folder or document appears in its own window, allowing users to drag and drop files between folders or compare contents side by side. Users can resize, move, or minimize windows to manage their workspace.
* **Icons:** Files and folders are represented by icons with visual cues indicating their type (e.g., document, image, application). Users can double-click icons to open files or right-click to access context menus with additional options.
* **Menus:** The application includes a menu bar at the top with options like "File," "Edit," "View," and "Help." Each menu contains a list of related commands (e.g., "New Folder," "Copy," "Paste," "Sort by"). Right-clicking on a file icon brings up a context menu with file-specific actions.
* **Pointers:** The mouse pointer changes shape based on its context (e.g., an arrow for navigation, a text cursor for editing, a hand for clicking links). Users can click to select files, drag them to move or copy, and use the pointer to interact with buttons and menus.

1. Ergonomics

**Ergonomics** is the scientific discipline concerned with understanding the interactions between humans and the elements of a system, with the goal of optimizing human well-being and overall system performance. It involves designing or arranging workplaces, products, and systems so that they fit the people who use them, aiming to reduce human error, increase productivity, and enhance safety and comfort.

**Example of Ergonomics in Practice**

**Office Workstation Ergonomics**

Consider the ergonomic design of an **office workstation**:

1. **Chair Design:**
   * An ergonomic office chair is designed with adjustable features to support different body sizes and shapes. Key features include:
     + **Adjustable Seat Height:** Allows the user to sit with feet flat on the floor, knees at a 90-degree angle, and thighs parallel to the ground, reducing strain on the lower back.
     + **Lumbar Support:** The chair provides support to the lower back to maintain the natural curve of the spine, preventing slouching and reducing the risk of back pain.
     + **Adjustable Armrests:** Armrests should be adjustable to allow the user’s arms to rest comfortably with shoulders relaxed, reducing tension in the shoulders and neck.
2. **Desk and Monitor Positioning:**
   * The desk and monitor should be positioned to reduce strain on the neck, back, and eyes:
     + **Monitor Height and Distance:** The top of the monitor should be at or slightly below eye level, and the screen should be about an arm's length away. This reduces the need to tilt the head up or down and minimizes eye strain.
     + **Desk Height:** The desk height should allow for a comfortable typing position, with the elbows at a 90-degree angle and wrists straight. This reduces strain on the wrists and forearms, lowering the risk of repetitive strain injuries such as carpal tunnel syndrome.
3. **Keyboard and Mouse Placement:**
   * The keyboard and mouse should be positioned to allow the user to keep their wrists straight and relaxed:
     + **Keyboard Placement:** It should be directly in front of the user, with a slight negative tilt to encourage a natural wrist position. The use of a wrist rest can further reduce strain.
     + **Mouse Placement:** The mouse should be close to the keyboard, allowing the user to keep their elbow close to their body and avoid stretching or reaching. An ergonomic mouse design can reduce the strain on the hand and wrist.

**1. Physical Ergonomics**

**Definition:** Physical ergonomics is concerned with the human body's responses to physical and physiological workloads. It focuses on the anatomical, anthropometric, physiological, and biomechanical characteristics of humans in relation to physical activity.

**2. Cognitive Ergonomics**

**Definition:** Cognitive ergonomics focuses on the mental processes involved in interactions among humans and other elements of a system. This includes perception, memory, reasoning, and motor response, as they affect human-system interactions.

**3. Organizational Ergonomics**

**Definition:** Organizational ergonomics is concerned with optimizing socio-technical systems, including organizational structures, policies, and processes. It focuses on the design of work systems that consider organizational structures, culture, communication, teamwork, and workflow.

1. **Human psychology**

Perception and Attention:

* Perception: How users interpret sensory information. Effective design uses visual contrast and size to highlight important elements.
* Attention: Users focus on certain elements while ignoring others. Minimize distractions to direct focus to crucial parts, like prominent buttons on a webpage.

Memory and Information Processing:

* Short-term Memory: Users can handle limited information at once. Avoid information overload by simplifying content.
* Long-term Memory: Consistency in icons and terminology helps users recall functions, such as grouping related commands in a "File" menu.

Learning and Adaptation:

* Learning: Intuitive design reduces the learning curve. Familiar patterns, like consistent keyboard shortcuts (e.g., Ctrl + C for copy), ease transitions between systems.
* Adaptation: Users become more efficient with experience. Consistent shortcuts across applications enhance proficiency.

Decision Making and Problem Solving:

* Decision Making: Clear labels and decision aids streamline choices. Breadcrumb navigation helps users understand their location on a site.
* Problem Solving: Clear error messages aid troubleshooting and navigating errors.

Emotion and Motivation:

* Emotion: Positive design enhances satisfaction. Gamification (e.g., badges) keeps users engaged and motivated by providing feedback and rewards.

1. List and explain two sub-types of long-term memory.

Long-term memory is a crucial component of the human cognitive system, and it can be divided into several subtypes. Two primary subtypes of long-term memory are **explicit memory** and **implicit memory**. Here’s an explanation of each with three key points and an example:

**1. Explicit Memory**

**Definition:** Explicit memory, also known as declarative memory, involves conscious recall of information. It is the type of memory where we actively and intentionally remember facts and events.

**Subtypes of Explicit Memory:**

* **Episodic Memory:**
  + **Definition:** Refers to the memory of specific events or experiences from an individual's life, including the context in which they occurred (e.g., time, place).
  + **Example:** Remembering your last birthday party, including who was there, what you did, and where it was held.
* **Semantic Memory:**
  + **Definition:** Refers to general world knowledge and facts that are not tied to specific personal experiences.
  + **Example:** Knowing that Paris is the capital of France or that 2 + 2 = 4.

**2. Implicit Memory**

**Definition:** Implicit memory, also known as non-declarative memory, involves unconscious recall of information and skills. It influences our behavior and performance without our conscious awareness.

**Subtypes of Implicit Memory:**

* **Procedural Memory:**
  + **Definition:** Refers to the memory of how to perform tasks and skills, often involving motor and cognitive routines.
  + **Example:** Being able to ride a bicycle without consciously thinking about how to balance or pedal.
* **Priming:**
  + **Definition:** Refers to the increased likelihood of recalling or recognizing information based on prior exposure or context.
  + **Example:** If you are shown the word "doctor," you are more likely to recognize the word "nurse" more quickly due to the semantic connection.

1. Models of Evaluation

**Norman's Execution-Evaluation Model**, also known as **Norman's Stages of Action Model**, is a conceptual framework in Human-Computer Interaction (HCI) that describes the process a user goes through when interacting with a system. Developed by cognitive scientist Don Norman, this model is used to understand how users formulate goals, perform actions to achieve those goals, and interpret the outcomes of their actions.

**Stages of Norman's Execution-Evaluation Model**

The model consists of **seven stages** grouped into two phases:

**1. Execution Phase**

This phase involves the steps a user takes to achieve a goal. It includes forming an intention, selecting actions, and executing those actions.

* **Goal Formation**: The user identifies and establishes what they want to accomplish. *Example:* A user wants to print a document.
* **Intention Formation**: The user decides on a plan or strategy to achieve the goal. *Example:* The user decides to use the "Print" function in their word processor.
* **Action Specification**: The user translates the intentions into specific actions or sequences of actions. *Example:* The user decides to click on the "File" menu and select "Print."
* **Execution**: The user physically performs the specified actions using the system's interface. *Example:* The user moves the mouse, clicks the "File" menu, and selects the "Print" option.

**2. Evaluation Phase**

This phase involves assessing the outcomes of the executed actions to determine if the goal has been met. It includes perceiving the results, interpreting the feedback, and comparing it to the original goal.

* **Perceiving System State**: The user observes the system's response to their actions. *Example:* The user sees a print dialog box appear on the screen.
* **Interpreting System State**: The user interprets the feedback provided by the system to understand the current state. *Example:* The user reads the print dialog box to ensure the correct printer is selected.
* **Evaluation**: The user compares the interpreted state against the original goal to determine if the action was successful or if further action is needed. *Example:* The user confirms that the correct printer is selected and clicks "Print," then checks to see if the document is printed correctly.

**Key Concepts in Norman's Model**

* **Gulf of Execution**: This "gulf" represents the gap between a user's intentions and the actions required to execute those intentions using the system. A wide gulf indicates a system that is difficult to use because the required actions are not obvious or are too complex.
* **Gulf of Evaluation**: This refers to the gap between the system's feedback and the user’s ability to interpret that feedback in the context of their goal. A wide gulf means the user struggles to understand whether their actions were successful based on the feedback provided by the system.

1. Human Senses

**Human Senses:**

1. **Sight**: Vision
2. **Hearing**: Auditory
3. **Touch**: Tactile
4. **Taste**: Gustatory
5. **Smell**: Olfactory

**Most Important to HCI:**

1. **Sight (Vision)**:
   * **Importance**: Critical for interface design as users primarily interact with visual elements like text, icons, and buttons. Effective use of color, contrast, and layout enhances usability and accessibility. For instance, clear visual hierarchies and readable fonts help users navigate and understand interfaces easily.
2. **Touch (Tactile)**:
   * **Importance**: Essential for interactions with touchscreens and physical interfaces. Tactile feedback, such as haptic responses, can confirm actions and improve the user experience. For example, vibrations or tactile sensations in touchscreens help users feel responses from their actions, making interactions more intuitive.
3. Individual differences

As an interface designer, here are five key individual differences to consider:

1. **Cognitive Abilities**: Users have varying levels of cognitive processing abilities, affecting how they understand and interact with interfaces. This includes differences in memory, problem-solving skills, and information processing speed.
2. **Visual Impairments**: Users may have different levels of visual acuity or color blindness. Designing for accessibility means ensuring that text is legible, colors are distinguishable, and alternative text is available for images.
3. **Motor Skills**: Variations in motor skills can impact how users interact with physical controls and touchscreens. Interfaces should accommodate both fine and gross motor skills, providing options like larger buttons and adjustable sensitivity.
4. **Cultural Differences**: Cultural backgrounds can influence user preferences and interpretations of symbols, colors, and language. Designing with internationalization in mind helps ensure that the interface is culturally sensitive and understandable to a global audience.
5. **Experience and Expertise**: Users have different levels of familiarity with technology. Interfaces should provide both novice-friendly features and advanced options for experienced users, ensuring a balance between simplicity and functionality.