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P101/1740G/21

COM 410

CAT TWO

HUMAN COMPUTER INTERFACE

QUESTION 1

Required:

1. Explain how you would undertake, requirement analysis, usability testing and Usability evaluation if the design is to be used for Mass production of the phone. [10 Marks]
2. Requirement Analysis

1. Recognize the intended audience:

Interview or hold focus groups with senior citizens to learn about their expectations, difficulties, and preferences.

2. Contextual Investigation:

To comprehend difficulties like interaction and navigation, observe how senior citizens use current phones or comparable gadgets in natural environments.

3. Consultation with Stakeholders:

Talk to family members, caretakers, and medical professionals who assist senior citizens.

4. Specify the needs:

Functional needs include things like voice assistants, big typefaces, and one-touch emergency calls.

1. Usability Testing

1. Construct prototypes:

Make both high-fidelity (interactive models) and low-fidelity (paper sketches or simple wireframes) phone prototypes.

Include elements such as larger physical buttons.

streamlined user interface with few settings.

feedback that is both tactile and auditory.

2. Find Volunteers:

Choose an elderly population that is diverse in terms of their physical and mental capacities as well as their degree of tech experience.

3. Perform Examinations:

Use activities like placing a call.

delivering a message.

Changing the brightness and volume, for example.

Keep an eye on their interactions and record any misunderstandings or challenges.

Keep track of metrics such as user satisfaction, error rates, and task completion time.

4. Get Input:

To acquire qualitative information about usability and pain points, employ surveys, structured interviews, and observations.

5. Make Design Iterations:

Improve usability by iterating prototypes in response to feedback before proceeding to production.

1. Usability Evaluation

1. Evaluation Criteria:  
  
Make use of recognized usability metrics such as:  
Effectiveness: Are users able to successfully finish tasks?  
Efficiency: How fast are users able to complete tasks?  
Customer satisfaction: Do consumers feel secure and at ease when using the phone?  
2. Techniques:  
  
Heuristic Assessment:  
  
Ask usability specialists to evaluate the design using guidelines such as error prevention, simplicity, and visibility.  
Cognitive Tour:  
  
To find out how user-friendly the interface is for senior users, simulate user scenarios.  
Field Examination:  
  
Give the phone to a sample of senior citizens so they can use it for longer periods of time every day.  
Track performance in the real world and get long-term input.  
3. Examine the findings:  
  
Determine what needs to be improved based on user input, performance data, and expert reviews.  
4. Verification:  
  
Make sure the design complies with ISO usability and accessibility standards (such as WCAG).

b) Explain how the following HCI Design principles have been used effectively in the design of computer user interface.

1) Affordance: Affordance is a term used to refer to an attribute of an object that allows people to know how to use it. For example, a mouse button invites pushing by the way it is physically constrained in its plastic shell. At a very simple level, to afford means “to give a clue.” When the affordances of a physical object are perceptually obvious it is easy to know how to interact with it.

2) Constraints: The design concept of constraining refers to determining ways of restricting the kind of user interaction that can take place at a given moment. There are various ways this can be achieved. A common design practice in graphical user interfaces is to deactivate certain menu options by shading them, thereby restricting the user to only actions permissible at that stage of the activity. There are three types of constraints

a) Physical constraints: Physical constraints refer to the way physical objects restrict the movement of things

b) Logical constraints: Logical constraints rely on people’s understanding of the way the world works. They rely on people’s common-sense reasoning about actions and their consequences.

c) Culture constraints: Culture constraints rely on learned conventions, like the use of red for warning, the use of certain kinds of signals for danger, and the use of the smiley face to represent happy emotions.

3) Mapping: This refers to the relationship between controls and their effects in the world. Nearly all artifacts need some kind of mapping between controls and effects, whether it is a flashlight, car, power plant, or cockpit. The mapping of the relative position of controls and their effects is also important

4) Visibility: The more visible functions are, the more likely users will be able to know what to do next. In contrast, when functions are “out of sight,” it makes them more difficult to find and knows how to use.

5) Feedback: Related to the concept of visibility is feedback. Feedback is about sending back information about what action has been done and what has been accomplished, allowing the person to continue with the activity. Various kinds of feedback are available for interaction design-audio, tactile, verbal, visual, and combinations of these. Deciding which combinations are appropriate for different kinds of activities and interactivities is central. Using feedback in the right way can also provide the necessary visibility for user interaction

Question 2

1. People can perceive the same information differently, discuss the factors that affect human information perception.

**1. Physiological Factors**

These relate to the physical condition and sensory capabilities of an individual.

* **Sensory Limitations:**

Vision impairments (e.g., color blindness, low vision) affect how visual information is perceived.

Hearing loss can influence the perception of auditory information, such as tones or speech.

* **Age:**

Older individuals may have slower processing speeds and difficulty interpreting fast or complex stimuli compared to younger individuals.

* **Health Conditions:**

Fatigue, illness, or neurological disorders can reduce the ability to focus or comprehend information effectively.

**2. Psychological Factors**

Cognitive and emotional states play a critical role in shaping perception.

* **Attention:**

Limited attention span or distractions can result in selective perception, where only certain aspects of the information are noticed.

* **Prior Knowledge and Experience:**

Familiarity with a topic influences how information is understood and interpreted. For example, technical jargon may be clear to experts but confusing to novices.

* **Emotions:**

Positive or negative emotional states (e.g., stress, happiness) can color the interpretation of information, leading to biases.

* **Memory:**

Short-term memory limitations may hinder the ability to process large amounts of information simultaneously.

* **Cognitive Biases:**

Preconceived notions or stereotypes can shape the way information is perceived and understood.

**3. Environmental Factors**

The context in which information is presented significantly impacts perception.

* **Noise and Distractions:**

External disturbances such as loud environments or cluttered interfaces reduce the clarity of the information.

* **Presentation Medium:**

The format (e.g., text, audio, video) affects how easily information is absorbed. For instance, diagrams may be easier to understand than dense paragraphs.

* **Lighting and Visibility:**
  + Poor lighting or low contrast can make visual information harder to perceive.

**4. Cultural Factors**

Cultural background profoundly influences how individuals interpret information.

* **Language:**

Differences in language or terminology can lead to misinterpretation of verbal or written communication.

* **Cultural Norms and Values:**

Symbols, colors, or gestures may have varying meanings across cultures, influencing interpretation. For example, red symbolizes danger in some cultures and celebration in others.

* **Cognitive Styles:**

Some cultures emphasize holistic thinking (focusing on context), while others focus on analytical thinking (focusing on details).

**5. Contextual and Situational Factors**

The situation in which information is presented can shape perception.

* **Urgency:**

Under time pressure, individuals may miss details or rely on heuristics to interpret information.

* **Relevance:**

Information perceived as irrelevant is more likely to be ignored or forgotten.

* **Social Influences:**

Peer opinions or social norms can sway how information is perceived, often leading to groupthink or conformity.

1. Describe how Task Analysis help with the design of user interfaces.

1.Creating Accessible Designs

Task analysis pinpoints particular needs for people with disabilities or other special needs. Making user interfaces accessible requires this.  
Task analysis, for instance, may show that people who are blind or visually impaired require larger text or other input methods, such as voice commands. In order to guarantee inclusivity, the user interface can be created to adhere to accessibility guidelines like WCAG.

2. Comprehending Workflow and User Behavior

• Task analysis shows the methods, procedures, and decision-making processes that users use to approach and complete tasks.   
•Designers can streamline the process by identifying bottlenecks, redundancies, or unnecessary steps through task observation and analysis.

3. Increasing Task Effectiveness and Cutting Down on Errors

Finding pain points or places where users may make mistakes or struggle is made easier with a well-conducted task analysis. This data is essential for creating interfaces that reduce errors.  
Task analysis, for instance, can identify areas where users may misinterpret input fields (like ambiguous labels) and make mistakes if the task entails entering data into a form. To minimize user errors, the designer can then modify the form fields, include useful tooltips, or instantly validate inputs.

4. Creating a flow and navigation that are clear

The logical flow of tasks within the interface is defined with the aid of task analysis. Designers can arrange features and content in a way that makes sense to users by knowing how tasks are sequenced.  
To prevent confusion, task analysis, for example, makes sure that each step of a multi-step process is presented in an orderly and clear manner (e.g., progress indicators or step-by-step wizards).

5. Setting Important Features and Functions First

Designers can prioritize the features in the user interface design that users depend on most to achieve their objectives by examining user tasks.  
To improve usability and user satisfaction, a feature like a search bar, for instance, can be made more visible or accessible if task analysis shows that it is frequently used in the system.

6. Adapting the User Interface to Context and User Skills

In order to ensure that the interface is designed appropriately for its audience, task analysis considers the contexts and experience levels of users.  
Expert users may want quicker access to advanced features, while novice users may benefit from more guidance and simpler workflows in the interface.

c) Discuss the concept of Human information processing and how it is used in HCI design.

(i)concept of Human information processing

* perception: The first step where sensory input (e.g., visual, auditory, tactile) is received and interpreted by the brain. This stage includes detecting and encoding stimuli from the environment.
* **Attention**: The process of focusing on relevant information while filtering out distractions. Humans can only process a limited amount of information at once, so attention helps prioritize critical data.
* **Memory**: Information is either discarded or stored in memory for later use. This includes short-term memory (working memory) and long-term memory (stored information).
* **Processing**: Cognitive processes (such as decision-making, problem-solving, and reasoning) take place to interpret the information and create responses based on the context and available knowledge.
* **Response**: The final stage where humans take action, such as responding to stimuli, making decisions, or performing tasks.

ii) how it is used in HCI design.

* Design for Attention:

Understanding the limits of human attention allows designers to create interfaces that don’t overwhelm the user with excessive information. Designers can highlight the most important elements on the screen, minimize distractions, and use cues (like bold text or color) to draw attention to key information.

 Cognitive Load Management:

Since humans can only process a limited amount of information at once, HCI design should avoid excessive cognitive load. Designers use techniques like chunking (grouping related information) to make complex tasks easier, breaking them into smaller, manageable steps. For example, multi-step forms are divided into different stages to avoid overwhelming the user.

 Memory Considerations:

Good UI design takes into account how memory works. For instance, providing visualfeedback (e.g., icons, progress bars) helps users remember what they are doing and where they are in a process. Also, consistent design patterns help users to quickly recognize functions and reduce reliance on memory.

 Clear Feedback and Response Time:

HCI design should include immediate and clear feedback to user actions (e.g., button presses, form submissions), as humans expect to see the result of their actions quickly. If there’s a delay, users should be provided with feedback (such as a loading spinner) to indicate that the system is processing.

 Error Prevention and Recovery:

Understanding that errors are common due to limitations in processing speed or attention, interfaces should be designed to prevent errors (e.g., through input validation) and provide easy recovery (e.g., undo buttons) when mistakes occur.

Question 3

a) Discuss the essential elements of User-Centered HCI Design

1. Visibility: Users should be able to see from the beginning what they can do with the product, what is it about, how they can use it
2. Accessibility: Users should be able to find information easily and quickly. They should be offered various ways to find information for example call to action buttons, search option, menu, etc.
3. Legibility: Text should be easy to read. As simple as that.
4. Language: Short sentences are preferred here. The easier the phrase and the words, the better.
5. Explain how HCI designers can mitigate ‘Gulf of Execution’ and ‘Gulf of Evaluation’ risks. [6 Marks]

i)how HCI designers can mitigate ‘Gulf of Execution’

* **Clear and Intuitive Interfaces:** Designers should create interfaces that make it easy for users to understand how to perform actions. This includes using recognizable icons, labels, and buttons that clearly represent their function. For instance, a trash can icon should clearly represent "delete."
* **Consistent Design**: Consistency in design helps users predict how to interact with different parts of the system. For example, if a system uses a "gear" icon for settings, it should use the same icon across all areas of the system to represent settings.
* **Affordances and Signifiers**: Provide visual cues that indicate how objects in the interface can be interacted with. For example, buttons should appear clickable (e.g., with shading or hover effects), and interactive elements should be designed to look like they can be manipulated.
* **Simplify Task Flows**: Keep interactions simple and task flows straightforward. Avoid unnecessary steps or complexities that require the user to figure out complicated processes.
* **Guidance and Assistance**: Provide users with help options, such as tooltips, onboarding tutorials, or inline instructions, which guide them through actions.

ii) how HCI designers can mitigate Gulf of Evaluation’

* Provide Immediate Feedback: Users should receive prompt and clear feedback that confirms the system is reacting to their actions. For instance, when submitting a form, a confirmation message or visual cue (e.g., a loading spinner) should indicate that the system is processing the action.
* Visibility of System Status: Ensure that users can easily understand the state of the system at any given time. For example, a progress bar or notification icon can show the status of an ongoing task, such as uploading files or waiting for a response.
* Error Prevention and Feedback: When users make mistakes, the system should provide clear, understandable error messages that explain the problem and offer solutions. For instance, if a user enters invalid data in a form, the system should highlight the error and give suggestions for correction.
* Clear Visual Indicators: Use visual design elements, such as color changes, animations, or sounds, to make the system’s status more obvious. For example, a green checkmark or red warning icon can indicate whether the user's action was successful or not.
* Support for Interpretation: Design interfaces that help users interpret the feedback they receive. For instance, instead of a generic error message like "An error occurred," the system could provide specific feedback, such as "Password too short. Please enter at least 8 characters."

c) Explain the following TWO factors considered in the design of HCL. [6 Marks]

i) Useful

**Usefulness** refers to how effectively a system or interface helps users achieve their goals or fulfill their needs. A system is considered useful when it provides practical and relevant features that users find valuable and necessary for their tasks. Key points regarding usefulness include:

* Addresses User Needs: The system should solve real problems or provide solutions that users actively seek. For instance, a health-tracking app is useful if it helps users monitor their exercise and diet.
* Meets Goals: A useful system enables users to accomplish their desired outcomes or tasks. For example, an online shopping platform is useful if it allows customers to browse, purchase, and manage their orders efficiently.
* Improves Productivity: A useful system should help users perform tasks more quickly, accurately, or easily. This could mean automation of repetitive tasks or providing valuable insights, like a calendar app organizing meetings.

ii) Usable

**Usability** refers to how easy and efficient it is for users to interact with a system. A system is considered usable when it allows users to perform their tasks with ease and minimal frustration. Key aspects of usability include:

* Ease of Learning: The system should be simple for new users to understand and navigate without extensive training. For example, a mobile app should have intuitive buttons and menus that users can easily learn to use.
* Efficiency: After learning the system, users should be able to complete their tasks quickly and effectively. For instance, a well-designed e-commerce website should allow users to search, add items to the cart, and checkout in a streamlined process.
* Error Prevention and Recovery: A usable system should prevent errors and make it easy to recover from them. For example, if a user enters incorrect data in a form, the system should offer clear, actionable feedback to guide correction.
* Satisfaction: A usable system should offer a pleasant user experience, where users feel comfortable, confident, and satisfied with their interactions. For instance, a visually appealing and responsive interface can contribute to higher user satisfaction.