

# CS408

## Introduction to Human-Computer Interaction

HCI is the study of how humans interact with computers and other digital systems, focusing on designing user-friendly interfaces that enhance usability and user experience.

### *Learning Goals*

- Understanding fundamental principles of HCI.
  - Exploring the interaction between humans and computers.
  - Recognizing challenges and advancements in the field.
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## Riddles for the Information Age

This concept refers to the challenges and paradoxes posed by modern technology, such as balancing usability with security, or automation with human control.

### *Role of HCI*

HCI addresses these riddles by designing systems that align with human needs, ensuring technology remains accessible and efficient.

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## Definition of HCI

HCI is a multidisciplinary field concerned with the design, evaluation, and implementation of interactive computing systems for human use.

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## Reasons for Non-Bright Aspects

Despite its benefits, HCI faces challenges such as:

- **Over-reliance on technology** leading to reduced human skills.
- **Privacy concerns** due to data misuse.

- **Inequality in accessibility**, such as software apartheid (discussed below).
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## **Human Versus Computer**

This explores the contrast between human abilities (e.g., creativity, emotional intelligence) and computer capabilities (e.g., speed, precision), emphasizing the need for complementary interaction.

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## **Software Apartheid**

A term highlighting unequal access to technology, where certain groups are excluded due to economic, social, or geographic barriers.

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## **An Industry in Denial**

This reflects the reluctance of tech industries to acknowledge issues like user privacy violations, unethical AI use, or unsustainable practices.

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## **Techno-Rage**

Refers to frustration caused by poorly designed systems or technological failures, emphasizing the importance of user-centric design.

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## **Success Criteria in the New Economy**

In a digital economy, success is driven by:

- Usability and accessibility of technology.
  - Innovation in interactive systems.
  - Responsiveness to user feedback.
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## **Computer + Information**

This explores the synergy between computing power and information management, forming the backbone of HCI.

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## Goals & Evolution of Human-Computer Interaction

### *Goals of HCI*

- Enhancing usability and user satisfaction.
- Designing systems that accommodate human limitations and strengths.
- Facilitating seamless human-computer interaction.

### *Evolution of HCI*

- Early focus on hardware interaction.
  - Shift to graphical user interfaces (GUIs).
  - Emergence of touch, voice, and gesture-based interactions.
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## Discipline of Human-Computer Interaction

### *Learning Goals*

- Explore the principles of interface design.
- Understand the interdisciplinary nature of HCI.

### *Quality*

Quality in HCI is defined by factors like usability, reliability, and efficiency of interaction.

### *Interdisciplinary Nature of HCI*

HCI draws from:

- Psychology (understanding user behavior).
  - Computer Science (developing systems).
  - Design (creating intuitive interfaces).
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## Cognitive Frameworks

### *Learning Goals*

- Understanding how humans process information.

- Applying cognitive models to interface design.

### *Introduction*

Cognitive frameworks in HCI focus on human thinking patterns and how they influence interaction with technology.

### *Modes of Cognition*

- **Automatic cognition:** Routine tasks requiring little thought.
- **Controlled cognition:** Tasks requiring active problem-solving.

### *Human Processor Model*

A model that views humans as processors of information with limits on memory, attention, and reaction time.

### *GOMS*

A predictive model (Goals, Operators, Methods, Selection rules) used to analyze user interaction and efficiency.

### *Recent Developments in Cognitive Psychology*

Advances like understanding multitasking, cognitive load, and decision-making inform HCI designs.

### *External Cognition*

How people use external tools (like notes or diagrams) to extend cognitive capabilities.

### *Distributed Cognition*

Examines how cognitive processes are shared across individuals, artifacts, and environments.

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## **Input-Output Channels**

### *Vision*

Vision is a primary input channel in HCI, and interfaces must consider factors like color perception, readability, and visual attention.

## Visual Perception

Visual perception is how humans interpret visual stimuli, crucial for designing user interfaces.

### *Learning Goals*

- Understand how users perceive and process visual elements.
- Apply principles of visual design to improve interface usability.

## Key Concepts

### 1. Color Theory

- Explains how colors interact and affect user perception.
- **Primary Colors:** Red, blue, yellow.
- **Complementary Colors:** Colors opposite each other on the color wheel.
- **Design Principles:** Use contrast for readability and harmony for aesthetics.

### 2. Stereopsis

- Refers to depth perception from binocular vision.
- Applications include 3D interfaces and augmented reality.

### 3. Reading

- Human reading behavior influences font choice, spacing, and layout.
- Key principle: Optimize for readability with appropriate fonts and text size.

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## Hearing

- Involves perceiving auditory cues.
- Applications: Notifications, voice interfaces, and auditory feedback.

## Touch

- Perception of tactile feedback, important in touchscreens and haptic devices.

## Movement

- Interaction based on gestures or physical movements, used in systems like Kinect or VR.

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## Cognitive Process

### *Learning Goals*

- Understand how users think and process information.
- Apply cognitive psychology to design user-friendly interfaces.

## Key Topics

1. **Attention**
    - Humans have limited attention; design should focus on minimizing distractions.
  2. **Memory**
    - **Revised Memory Model:** Considers short-term, long-term, and working memory.
    - Design Implications: Reduce memory load by providing cues and prompts.
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## Learning

### Key Skills

1. **Reading, Speaking, and Listening**
  - Interfaces should accommodate diverse user preferences for consuming information.
2. **Problem Solving, Planning, Reasoning, and Decision-Making**
  - Design tools to support complex tasks, e.g., dashboards for data analysis.

### The Psychology of Actions

- Explores how users translate intention into action and the role of feedback.
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## Mental Model

- The user's understanding of how a system works, which guides interaction.
- Design should align with users' mental models for intuitive use.

## Errors

- Errors occur when the system doesn't align with user expectations.
  - **Design Principle:** Provide clear error messages and recovery options.
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## Design Principles

### *Learning Goals*

- Recognize and apply foundational design principles.
  - Create effective, user-friendly interfaces.
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## The Computer

### *Learning Goals*

- Explore the hardware and software that enable HCI.

## Input Devices

- **Text Entry Devices:** Keyboards, on-screen keyboards.
- **Positioning, Pointing, and Drawing:** Mice, styluses, touchpads.

## Display Devices

- Monitors, VR headsets, augmented reality displays.

## Touch, Feel, and Smell

- Innovations include tactile feedback, smell-based interfaces for immersive experiences.

## Physical Controls

- Buttons, sliders, knobs in physical devices.

## Environment and Bio-Sensing

- Integration of sensors for temperature, motion, and physiological data.

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## Interaction

### *Learning Goals*

- Understand the dynamics of human-computer interaction.

## Key Concepts

1. **The Terms of Interaction:** Inputs, outputs, feedback.
2. **Donald Norman's Model:** Explains user actions through goals, intentions, and execution.
3. **The Interaction Framework:** Breaks interaction into communication between user and system.

## Interaction Styles

- Command-line interfaces, menus, WIMP (Windows, Icons, Menus, Pointers), natural user interfaces (NUIs).

## Interaction Paradigms

- Innovations like touch, voice, and augmented reality.

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## HCI Process and Models

### *Learning Goals*

- Understand lifecycle models and methodologies in HCI design.

## Lifecycle Models in HCI

### 1. Goal-Directed Design

- A user-centered approach focusing on achieving user goals.
- **Process Overview:** Research → Design → Prototype → Evaluate.

## Types of Users

- Primary, secondary, tertiary users with varying needs and interaction levels.
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### User Research

#### *Learning Goals*

- Learn research methods to understand user behavior.

### Qualitative Research

- Methods include interviews, focus groups, and observation.

### User-Centered Approach

- Focuses on designing systems around user needs and preferences.
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### Ethnography Framework

- In-depth studies of users in their natural environments.

### Preparing for Ethnographic Interviews

- Develop clear objectives and conduct pre-interview research.

### Putting a Plan Together

- Align research goals with project requirements and user needs.

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