

Course: Human Computer Interface (HCI)

Week 1: Introduction to HCI – The Human Concept

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Course Description

- The course begins with an introduction to Human Computer Interface (HCI) concepts, i.e. the human (brain, human visual system, visual perception and optical illusions), the computer and the interface perspectives.
- Theories and principles to design for attention will be covered and thereafter psychological and social interaction to address use of cognition and use of proper language and metaphors (menus).

Course Description ...

- User-centered design and human-centered design will be covered in detail to understand how the two terminologies are similar and how they differ.
- Architectures for user interfaces mainly Graphical User Interface will lead the course coverage to user experience, universal design, design principles, heuristics and golden design rules.
- Information retrieval and utilization architectures will then be connected to designing rich interactive systems using styles that enhance usability (web and mobile) and easy navigation.
- User experience and support will be covered as we look into methods of evaluating interactive systems

Course objectives

Upon successful completion of the Human Computer Interface (HCI) course, the learners will be equipped with necessary knowledge and skills in the concepts, theories, techniques and tools to study, design, evaluate and develop interactive computing systems that are usable in both web and mobile interfaces.

The learning outcomes of the course will be to enable learners to: -

1. Describe and apply core theories, models and methodologies from the field of HCI.
2. Design, evaluate and implement effective and usable Graphical Computer Interfaces.
3. Describe special considerations in designing User Interfaces.
4. Describe and discuss current research in the field of HCI.

Learning outcomes Week 1: Introduction to HCI – The Human Concept

At the end of the lecture, you will be able to:

1. Define Human Computer Interface (HCI) concepts
2. Describe the human aspect of HCI i.e. human visual system, ergonomics and human memory
3. Explain the basic goals of HCI.

Introduction: Definition: Human Computer Interaction (HCI)

- **Human Computer Interaction (HCI)** refers to how people (users) interact with computers.
- HCI is the link between computer science, behavioral science, design and several other fields of study.
- In this course the terms Human Computer Interface and Human Computer Interaction will be used interchangeably.

Definition: User Interface

- Interaction between human (users) and computers occur at the **user interface level** (or simply interface), which consists of hardware and software components.
- Examples of user interfaces are characters or objects displayed by software on a personal computer's monitor.

- Input is normally received from users through hardware devices such as keyboard, key pad, light pen and mouse among others.
- The Association for Computing Machinery (ACM) defines human-computer interaction as "a discipline concerned with the *design, evaluation and implementation of interactive computing systems for human use.*"

- The human (user) is the one whom computer systems are developed to assist therefore, an important feature of HCI is *user satisfaction*¹.
- Human Computer Interaction deals with how people interact with computers and to what extent computers are developed for successful interaction with human beings.
- Many academic institutions and major corporations now study HCI to understand the major phenomena surrounding them.

- Human Computer Interaction studies humans and machines in parallel while drawing from supporting knowledge from both sides.
- On the machine side, techniques in computer graphics, operating systems, programming languages, and development environments are relevant.
- On the human side, communication theory, graphic and industrial design disciplines, linguistics, social sciences, cognitive psychology, social sciences and human factors are relevant.
- Engineering and design methods are also relevant.²

2. Human-computer interaction (3rd ed.), Dix, A., Finlay, J., Abowd, G., & Russell, B. New Jersey: Prentice Hall. ISBN-10: 0130461091, ISBN-13: 978-0130461094, (2004) Pg. 19

- Due to the multidisciplinary nature of HCI, people with different backgrounds contribute to its success.
- HCI is also sometimes referred to as **Man–Machine Interaction (MMI)** or **Computer–Human Interaction (CHI)**.

User Focus

- *Think 'User'* - The value of any interface design technique is that it forces the designer to remember that someone will use the system under construction.

- *Involve users* – Whenever possible, users need to be involved in the design process since they have vital knowledge and are able to find flaws easily.
- Model Iterations and early prototypes that are less precious and easier to throw away are a crucial in the development process since it is hard to get it right the first time³.

Ergonomics or Human Factors

- Ergonomics is the study of **how people and their work interact.**
- The purpose of ergonomics is to define and design tools and various artifacts for different work, leisure and domestic environment to suit the capacities and capabilities of users.

- **The role of ergonomics** is to maximize operators such as safety, efficiency and reliability of performance to make a task easier and to increase feelings of comfort and satisfaction.
- Ergonomics is about designing for people, good products, systems or processes that they interact with.
- Normally, **people don't notice good design** (unless perhaps, it's exceptional) because it gives us no cause to, **however, people will always notice poor design.**

- Ergonomics aims at **ensuring that designs complement the strengths and abilities of people while minimizing the effects of their limitations, rather than forcing them to adapt.**
- To achieve this, it becomes necessary to understand and design for the variability represented in the population, spanning such attributes as **age, size, strength, cognitive ability, prior experience, cultural expectations and goals.**

- Qualified ergonomists are the only recognised professionals to have competency in optimising performance, safety and comfort. The goals of ergonomic studies to *reduce injuries, improve performance, and in general make your work more comfortable and safer.*
- **Wrist aches** after a session at your computer, means you are experiencing a **problem with ergonomics.**
- Discomfort can happen to people working with computers improperly e.g. carpal tunnel syndrome, severe headaches, and eyestrain.

• **Information Channels**

- Users receive information through the senses and in particular, computer information is received by human beings through sight, hearing and touch.
- This means that humans are limited in their capacity to process information and hence they need to have an interface.
- Information is received and responses are given via various input channels such as: -

A. Visual channels

- Vision begins with light and the human eye is the mechanism for receiving light and transforming it into electrical energy.

- Light is reflected from objects in the world and their image is focused upside down on the back of the eye⁴.
- The receptors in the eye transform it into electrical signals which are passed to the brain.

B. Audio channels

- The sense of hearing is often considered secondary to sight.
- The amount of information that we receive through our ears cannot be underestimated⁵.

4. Human-computer interaction (3rd ed.), Dix, A., Finlay, J., Abowd, G., & Russell, B. New Jersey: Prentice Hall. ISBN-10: 0130461091, ISBN-13: 978-0130461094, (2004) Pg. 41

5. Human-computer interaction (3rd ed.), Dix, A., Finlay, J., Abowd, G., & Russell, B. New Jersey: Prentice Hall. ISBN-10: 0130461091, ISBN-13: 978-0130461094, (2004) Pg. 50

C. Haptic channels

- The third sense to consider is touch or *haptic perception*. Touch provides vital information about the environment and is therefore an important means of feedback⁶.
- When using computer systems, touching is important e.g. feeling buttons move downward is a crucial part of the task of pressing the button.
- For the average person, haptic perception is a secondary source of information, but for users whose other senses are impaired, it may be vitally important.
- For blind users, interfaces such as braille may be the primary source of information in the interaction.

D. Movement

- Movement is about motor control and the way users move affects their interaction with computers.
- Speed and accuracy of movement are two important parameters to consider in the design of interactive systems, mainly in terms of the time taken to move to a particular target on a screen e.g. a button, a menu item or an icon.⁷

Human Memory

- Our daily activity relies on memory that stores all our factual knowledge or procedures.
- Information is stored in various types of memory: -
 - i. Sensory memory which acts as a buffer for stimuli received through the senses
 - ii. Short-term (working memory) for temporary recall of information.
 - iii. Long-term memory where we store everything that we know i.e. factual information, experiential knowledge, procedural rules of behaviour. Long-term memory differs from short-term memory in three ways: -
 - a) High unlimited capacity.
 - b) Slow access time.
 - c) Memory loss occurs more slowly in long-term memory⁸

- Humans are able to use information to reason and solve problems even when available information is partial or completely unavailable.
- Human thought is conscious and self-aware and even if humans may not always be able to identify the processes they use, they can identify the products of these processes.

- Humans are able to think about things of which they have no experience, and solve problems which they have never seen before. This is done through information processing and is applied via:-

- a) Reasoning** - The process of using available knowledge to draw conclusions or infer something new about the domain of interest.
Reasoning can either be *deductive*, *inductive* or *abductive*.
- b) Problem solving** - Finding a solution to an unfamiliar task using available knowledge.

- c) **Skill acquisition** - In most cases the problems faced by humans are not completely new, instead, humans gradually acquire skills in a particular domain area.

- d) **Human Error** - Humans do make mistakes, some trivial, others more serious, requiring substantial effort to correct⁹.

Human Capabilities and Differences

- Human capabilities are influenced by emotion and many humans (users) share common capabilities. However, there are individuals with differences and they should not be ignored when systems are designed. It is important to understand the human capabilities and their limitations as information processors so that interactive systems can be designed to support both scenarios.

Goals of HCI

- HCI main goal is to improve the interactions between users and computers by making computers more usable and receptive to the user's needs.
- Specifically, HCI is concerned with the following issues:
 - i. Approaches to design interfaces such that when presented with a task and a class of users, it is possible to design the best possible interface within given constraints while optimizing the desired features such as learnability or efficiency of use

- ii. Methods to implement interfaces e.g. software toolkits and libraries; efficient algorithms
- iii. Techniques to evaluate and compare interfaces
- iv. Developing new interfaces and interaction techniques
- v. Developing descriptive and predictive models and theories of interaction

- The long-term goal of HCI is to design systems that **minimize the barrier** between the **human's cognitive model** of what they want to accomplish and the **computer's understanding of user's needs.**

Conclusion

- Human Computer Interface is a link between humans and technology and the interface systems aim at enhancing the quality of interaction between humans and computer systems.
- This is achieved through systematically linking the knowledge about human and computer goals, capabilities and limitations.

Content Covered in Week 1: Introduction to HCI – The Human Concept

- i. We have defined various Human Computer Interface (HCI) concepts
- ii. We have described the human aspect of HCI i.e. human visual system, ergonomics and human memory
- iii. We have discussed the basic goals of HCI.

Course Text Books

1. Human-computer interaction (3rd ed.), Dix, A., Finlay, J., Abowd, G., & Russell, B. New Jersey: Prentice Hall. ISBN-10: 0130461091, ISBN-13: 978-0130461094, (2004).
2. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002).
3. Designing the user interface: Strategies for effective human-computer interaction (5th ed.), Shneiderman, B., Plaisant, C., Cohen, M., & Jacobs, S. New Jersey: Prentice Hall. ISBN-10: 0321537351, ISBN-13: 978-0321537355, (2009).