

Course: Human Computer Interface (HCI)

Week 1: Introduction to HCI – The Human Concept

Lecturer: Martha Gichuki

Lecture learning outcomes

At the end of this lecture the learner will be able to:

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

1. Introduction

1.1. Definition: Human Computer Interaction (HCI)

Human Computer Interaction (HCI) refers to how people (users) interact with computers. This is often regarded as the link between computer science, behavioral science, design and several other fields of study.

Interaction between 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 received from users through hardware devices such as keyboard, key pad, light pen and mouse among others. In this course the terms Human Computer Interface and Human Computer Interaction will be used interchangeably.

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 or are not developed for successful interaction with human beings. Many academic institutions and major corporations now study HCI to understand the major phenomena surrounding them.

Since human-computer interaction studies a human and a machine in conjunction, it draws from supporting knowledge on both the machine and the human side. On the machine side, various 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. 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)**.

1.2. 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.

Engage users – Whenever possible, users need to be involved in the interface design process since they have vital knowledge and are able to find design faults easily. Model iterations need to be created and early prototypes that are less precious and easier to throw away are crucial in the development process since it is hard to get it right the first time.

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) Pg. 39

1.3. 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.

2. Information Channels

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

2.1. Visual channels

Vision begins with light and the human eye is the mechanism that receives light and transforms it into electrical energy. Light is reflected from seen objects in the world and the image of these

objects is then focused upside down on the back of the eye.² The receptors in the eye transform it into electrical signals which are passed to the brain for storage.

2.2. Auditory channels

Many a times, the sense of hearing is often considered secondary to sight, but the amount of information that we receive through the ears cannot be underestimated.³

2.3. Haptic channels

The third sense to consider is the sense of touch or *haptic perception*. Although this sense is often viewed as less important than sight or hearing, it provides vital information about the environment and is therefore an important means of feedback.⁴ When using computer systems, touching is important e.g. feeling keyboard 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 example, for blind users, interfaces such as braille may be the primary source of information in the interaction. The importance of touch should not therefore be underestimated.

2.4. 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 icon⁵.

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. 41

³ 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

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. 52

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. 54

3. Human Memory

Most of our everyday activity relies on memory that stores all our factual knowledge or procedures.

Information is stored in various types of memory: -

- a) Sensory memory which acts as a holding area for stimuli reactions that are received through various senses
- b) Short-term or working memory for temporary recall of information.
- c) Long-term memory where we store everything that we know i.e. factual information, experiential knowledge and procedural rules of behaviour. Long-term memory differs from short-term memory in three ways: -
 - i. High unlimited capacity.
 - ii. Slow access time.
 - iii. Memory loss occurs more slowly in long-term memory compared to short term memory⁶

Human beings 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. Human beings 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:-

- (i) **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*.
- (ii) **Problem solving** - Finding a solution to an unfamiliar task using available knowledge.
- (iii) **Skill acquisition** - In most cases the problems faced by humans are not completely new, instead, humans gradually acquire skills in a particular domain area.

⁶ 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. 54 - 63

3.1. Human Error - Humans do make mistakes, some trivial, others more serious, requiring substantial effort to correct.⁷

3.2. 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.

4. Goals of HCI

HCI main goal is to improve the interactions between users and computers by making computers more usable and receptive to user 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 human's cognitive model of what they want to accomplish and the computer's understanding of user needs.

Professional HCI practitioners are usually designers who apply design methodologies to real-world problems and their work often revolves around designing Graphical User Interfaces (GUIs) and Web Interfaces.

Generally, research in HCI is ongoing and researchers in HCI are interested in developing new design methodologies, experimenting with new hardware devices, prototyping new software

⁷ 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. 67 – 78

systems, exploring new paradigms for interaction, and developing models and theories for better interactions.

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.

References

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).