Priyadarshini College of Engineering, Nagpur

Department: Artificial Intelligence and Data Science

SESSION: 2022-2023

Human Computer Interaction

Unit-I

Introduction to HCI:

Human-computer interaction (commonly referred to as HCI) researches the design and use of computer technology, focused on the interfaces between people (users) and computers. Researchers in the field of HCI both observe the ways in which humans interact with computers and design technologies that let humans interact with computers in novel ways.

User

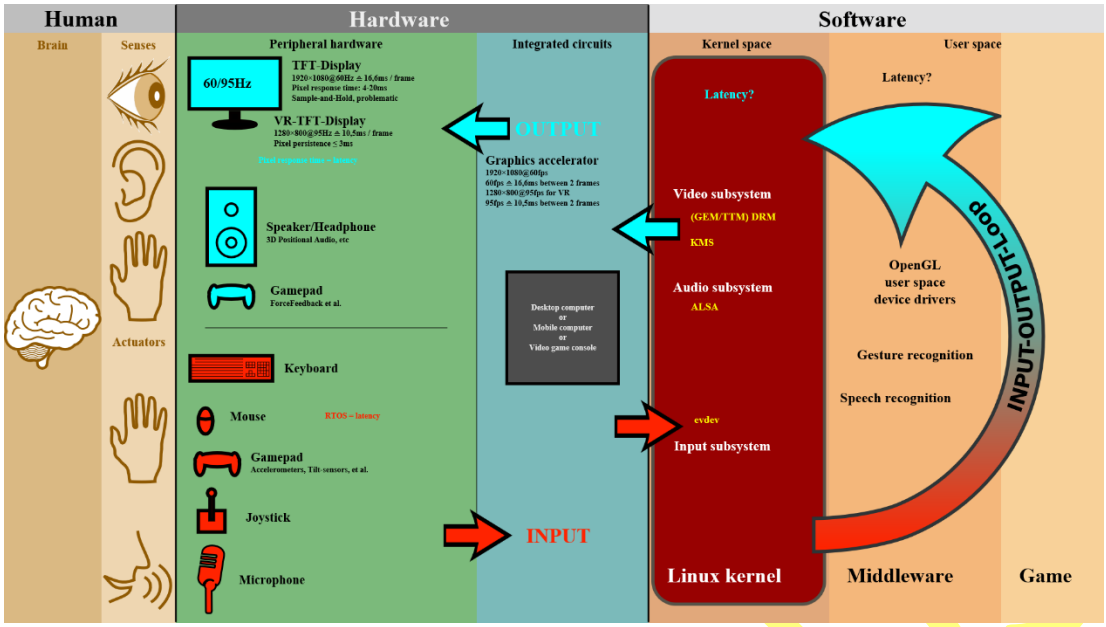
By "user", we may mean an individual user, a group of users working together. An appreciation of the way people's sensory systems (sight, hearing, touch) relay information is vital. Also, different users form different conceptions or mental models about their interactions and have different ways of learning and keeping knowledge and. In addition, cultural and national differences play a part.

Computer

When we talk about the computer, we're referring to any technology ranging from desktop computers, to large scale computer systems. For example, if we were discussing the design of a website, then the Website itself would be referred to as "the computer". Devices such as mobile phones or VCRs can also be considered to be ―computers‖.

Interaction

There are obvious differences between humans and machines. In spite of these, HCI attempts to ensure that they both get on with each other and interact successfully. In order to achieve a usable system, you need to apply what you know about humans and computers, and consult with likely users throughout the design process. In real systems, the schedule and the budget are important, and it is vital to find a balance between what would be ideal for the users and what is feasible in reality.



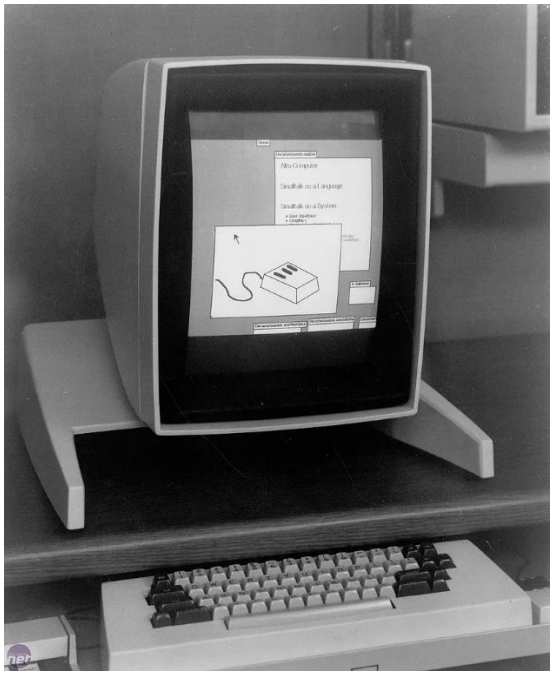
History of HCI:

Until the late 1970s, the only humans who interacted with computers were information technology professionals and dedicated hobbyists. This changed disruptively with the emergence of personal computing in the later 1970s. Personal computing, including both personal software (productivity applications, such as text editors and spreadsheets, and interactive computer games) and personal computer platforms (operating systems, programming languages, and hardware), made everyone in the world a potential computer user, and vividly highlighted the deficiencies of computers with respect to usability for those who wanted to use computers as tools.

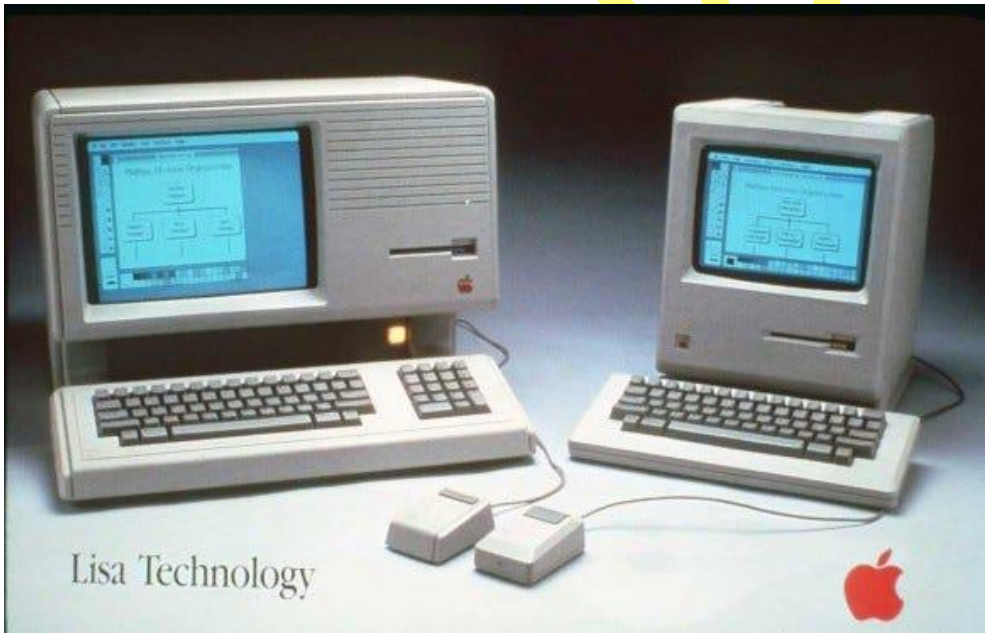
The origins of HCI can be traced back to the late 1970s and early 1980s, as personal computers began to gain popularity and the need for more user-friendly interfaces grew.

Several key individuals and institutions contributed to the development of HCI during its early years

Xerox PARC and the Graphical User Interface : The research team at Xerox PARC, led by Alan Kay, developed the first graphical user interface, which allowed users to interact with computers through visual elements such as icons, menus, and windows. This breakthrough significantly enhanced usability by enabling users to navigate computer systems more intuitively.



Apple's Lisa and Macintosh: Apple's Lisa (1983) and Macintosh (1984) computers were among the first commercially available systems to incorporate a GUI, popularizing the concept and making it more accessible to a wider audience.



Ben Shneiderman's "Eight Golden Rules of Interface Design": In 1986, Ben Shneiderman, a pioneer in HCI, published his "Eight Golden Rules of Interface Design," which provided guidelines for creating effective and user-friendly interfaces. These rules emphasized consistency, feedback, flexibility, and error prevention, among other principles, and continue to influence UX design today.

Issues and challenges:

There are some issues that are important in human-computer-interaction and that we have to have in mind when designing an interface of a learning environment:

1. **practice** (the performance improves with practice)
2. **transfer** (experts are able to transfer previous knowledge to the current task, whereas novice need carefully designed interfaces)
3. **exploration** (exploration and the factors that ease the exploration has become one of the most important ways to learn an interface)
4. **vocabulary** (the vocabulary of users (the commands) increase but the use of the vocabulary is somewhat stationary),
5. **flexibility** (although flexibility in the interface is present it is unlikely to be used because of all the other interaction going on).

HCI faces several challenges, especially from a personal, organizational, administrative, psychological, social, or cultural perspective.

1. Learnability: One of the usability criteria is learn ability. Learning ability occurs in relation to software or electronic devices that bridge human-machine interaction. The most common applications are those that follow the conventions of other similar programs. Streamline learning by creating a simple user interface design with predictable layout and navigation. A good way to improve learning ability is to examine the user's guesses before using the application.

2.Generalizability and Consistency: Extending knowledge of a particular interaction to new situations helps It helps bring some consistency to the proposed system model. The Consistency Principle supports users by allowing them to transfer knowledge from one application to another. The application should be consistent with the current version of the product, its use of metaphors, and user expectations. The latter has individual differences and is the type that requires the most consistency.

3.Perceived Consistency: The concept of perceived stability is closely related to the principle of consistency. For example, it gives users a visual sense of stability even when certain actions are not available. They are not removed from the appearance, just grayed out.

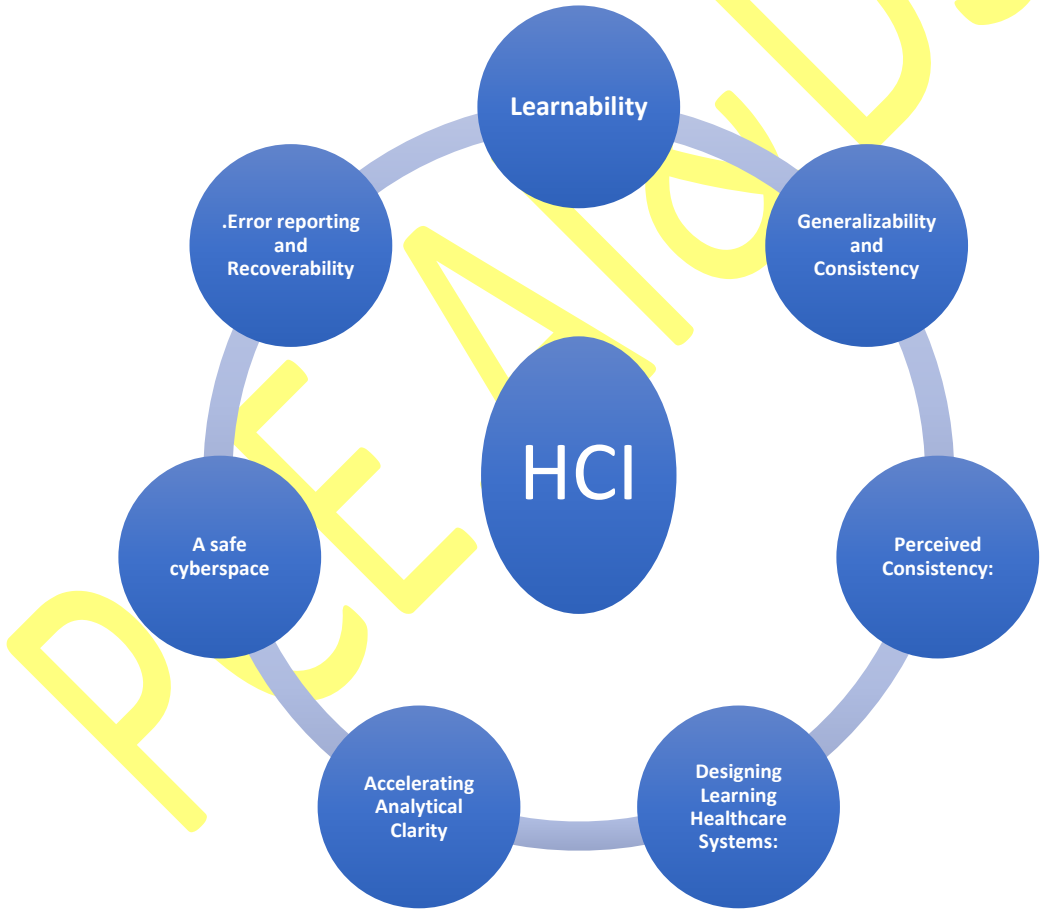
4.Designing Learning Healthcare Systems: A Key Moment for HCI Researchers and Designers is Connecting Patients Seeking Health, Clinicians Delivering Care, and Providers Looking to Reduce Costs While Improving Quality of Care That's it. Help form a large healthcare system. Macro-HCI mindsets and big data analytics tools can provide insights at all levels that can be shared with relevant stakeholders, but driving meaningful change in such large-scale systems remains a challenge. . Bottom-up strategies foster patient and physician engagement, but top-down governance is required to set policy, deal with bad actors, and drive continuous improvement.

5. Accelerating Analytical Clarity: The big data movement is generating massive amounts of heterogeneous data. Its analysis leads to a better understanding of the invisible processes in business, community growth/decline, learning and public health. This better

understanding, enhanced by well-integrated visual interfaces and statistical techniques, can lead to safer and bolder decisions that improve the well-being of individuals, communities and the planet.

6. A safe cyberspace: Criminal activity and data breaches threaten to reduce engagement, participation, political involvement and tool use in all types of transactions. Designed with usable privacy and security in mind, it maintains benefits, minimizes intrusions, and meets security expectations.

7.Error reporting and Recoverability: The user should be able to understood which user actions have led to the present state, and what the system did to reach there. We need to find out if they there are somehow invisible states that result to the current state. Unless the user can learn to remember any possible path leading up to an identifiable state, the publishing of possible paths appears unnecessary. Support for undoing errors should be given for the of user to take disciplinary action once an error has been recognized.



The following table highlights all the significant differences between the Human Brain and a Computer –

Human Brain	Computer

Brain is constituted with neurons and synapses.	Computer can be constructed using IC, transistors, diodes, capacitors, and transistors.
The memory growth of a brain increases every time synaptic links are connected.	The memory growth of the computer can be increased by adding memory chips to it
The brain has a built-in backup system.	The backup systems are manually constructed.
Brain has a memory power of about 100 teraflops (approx. 100 trillion calculations/seconds)	Computer has a memory power of about 100 million megabytes.
The memory density of the brain is 10^{7} circuits/cm^{3}.	Computer has a memory density of 10^{14} bits/cm^{3} .
The energy consumption is 12 watts of power.	The energy consumption is in terms of gigawatts of power.
The information is stored as electrochemical and electric impulses.	The information is stored in numeric and symbolic form (as in binary bits).
The weight of the brain is around 3.3 pounds.	Its size and weight varies depending on type system- from a few grams to tons.
The information is transmitted using chemicals that fire the action potential in the neurons.	The communication happens using electrical coded signals.
The information processing ability of the brain is low.	Computer has the ability to process large amounts of information.
The input or output equipment is the sensory organs.	The input and/or output equipment includes keyboards, mouse, web cameras.
Brain is self-organized.	Computer has a pre-programmed structure.
Brain implements massive amounts of parallelism.	Computer has limited parallelism.
Brain is reliable, and self-maintaining.	Since computer performs a monotonous job, it can’t rectify its mistakes on its own.

Human Being	Computer Machine

There is a combination of male and female in the creation of human. And it has to go through different conditions for 9 months.	There is a variety of parts joined each other by humans to make a computer. It is the most important invention of human beings.
A human is a living being having living characteristics like using food and water with a need base and having emotions.	A computer is a nonliving thing, it is an electronic device made by humans and consumes electricity, and is emotionless.
A human has a brain and can think creatively from different angles.	A computer has no brain and can't think creatively. It works just what has been faded through commands
A human makes decisions according to his thoughts. The brain keeps the information about the spatiality and size of objects, giving us this information in a matter of seconds. The brain shows a greater knowledge of the world.	A computer can't think, it is a programmable machine doing work according to the given commands. The computers cannot provide information about the objects.
A human brain works as an analog with different processing speeds.	A computer works digitally with a high processing speed.
A human can use a computer for doing any specific job.	A computer can't use a human and can't do any job by itself.
A human brain is a greatly parallel machine.	A computer is a modular and serial machine
A human brain has no software for execution and doing any job.	A computer has software for any command execution.
Probably human is working as single user.	A computer is a multi-user machine. It can perform multiple tasks at the same time.
Human has short-term memory to do with nearby indications and ideas that lead to long-term memory.	While Computer RAM contains information equal to the one on the hard disk. In addition, the RAM has a fixed capacity, while the short-term memory is fluctuating and changes according to the person and experience.
The human brain depends on factors such as the time of the electrochemical signals, which determine some neuronal activities. In addition, brain time is not the same as a clock, but rather as waves.	The computer has a digital clock, and its parts act at a specific time.

Cognitive Psychology:

Cognitive psychology encompasses various psychological processes such as attention, memory, sensation, perception, language use, intelligence, emotions, thinking, visualization, neuroscience, and other processes.
Cognitive psychology contains many theories, methods, and principles that are used in the analysis and interpretation of mental phenomena in humans.

Sensation in Cognitive Psychology: Perhaps you know since primary school that we have five senses: vision, hearing, taste, smell, touch.

The idea ofthe five senses turned out to be exaggerated.
We also, have sensitive systems that provide information about equilibrium, position, and movement of the body, pain, and temperature.

A sensation is the first step in a chain of biochemical and neurological events ranging from the energetic stimulus of a sensory organ to perception.

Although the classification of sensations varies according to cultural context and physiology, the sensory systems of the human being are described in biology according to three categories:

Exteroception: It includes vision, hearing, olfaction, general somesthesis, and taste.

Proprioception: This is the sensation of muscular tension, position and movement, balance and displacement.

Interception: It is vegetative somesthesis and unconscious sensory modalities.

There are some specialized neurons in the brain known as sensory receptors that respond to specific types of stimuli.
A sensation occurs when sensory information is detected by a sensory receptor. For example, the light which enters the eye causes a chemical change in the cells, which is the line behind the eye.
These cells relay messages to the central nervous system, in the form of work capacity and action potentials

Perception as Cognitive and Mental Processes

The process by which people transform sensory impressions into a consistent and integrated approach to the world around them.
Although essentially based on unverified and incomplete information, for most practical purposes, perception is similar to reality and guides human behavior in general.

There are many different definitions of the perceptual process in general:

Perception is a process of the psychological processes through which the individual recognizes and reaches the meanings of individuals, objects and different stimuli, and understanding their implications, by organizing sensory stimuli and interpreting them and formulating them in independent units with their own meanings.

The comprehensive definition of perception is given as it is a mental process, which helps man to know his external world, and to reach the meanings and connotations of things, by organizing sensory stimuli, to interpret and formulate them in faculties of meaning.
The following points illustrate the meaning and characteristics of perception:

Perception is defined as the total set of responses to sensory stimuli produced by different external stimuli, which the individual receives through sensory nerves in sensory organs.

The perceptual process is the result of stimulation of sensory organs, through external stimuli, to interpret external sensations through perceived experiences, ie, the interpretation and realization of sensory impressions are based on experiences and knowledge previously stored in memory.

It can be said that the process of perception is a highly complex sensory-emotional process; it interferes with feeling, processes of remembering, imagination, attention, awareness, and language.

Some perceptual processes may include the recognition of material objects by their names and most essential functions and may include the different meanings and forms of relationships that govern certain physical stimuli.

Problem Solving

Many people are exposed to many problems in their lives, which require finding the right solution for them.

The mechanism used by man to solve the problem that he has encountered is what we call the mental process, which a person does in order to arrive at a solution that was not clear to him.

This requires a person to take certain actions, to be used, and to get the person to what he wants.

Memory

Memory is a set of human mental processes, in which external information is acquired, retained, and used for the future.

Many human functions require two mental processes that work together to perform these functions: memory and Perception.

When a person receives new information and conducts a dialogue, he keeps the information for a short period of time that is called temporary memory or short-term memory.

The information is then transferred to permanent memory which is called long-term memory.

Prof.U.A.S.Gani
(Subject Teacher)

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