ICT 116 - HUMAN – COMPUTER INTERACTION 1

Module 3: Human Computer Interaction Related Fields

Module Introduction/Rationale:

This module introduces the related fields that involves Human Computer Interaction (HCI).

Module Outcomes:

At the end of this module, the students must have:

1. discussed current research in the field of HCI;
2. explained other fields that are related to HCI where it has been drawn; and
3. identified certain fields that has a great contribution in HCI.

Lesson 1: Related fields of Human Computer Interaction

Lesson Outcomes:

At the end of the lesson, the student must be able to explain other related fields that involves Human Computer Interaction (HCI).

Lesson Content:

The field of HCI is not limited to computer engineering, software engineering, computer science, or any areas within the field of computer technology. HCI is one of the broad areas of technology which also uses the knowledge and skills of psychology, sociology, and phenomenology just to name a few.
Here are some of the fields related to HCI:

A. Psychology

Psychology is a science that studies the behavior and mind. It embraces all aspects of conscious and unconscious experience as well as thought. Psychology is an academic discipline and a social science that seeks to understand individuals and groups by establishing general principles and researching specific cases. Professionals in this field are called psychologists and their primary function is to explore behavior and mental processes, including perception, cognition, attention, emotion (affect), intelligence, phenomenology, motivation (conation), brain functioning, and personality. This extends to interaction between people, such as interpersonal relationships, including psychological resilience, family resilience, and other areas. Psychologists of diverse orientations also consider the unconscious mind. Psychologists employ empirical methods to infer causal and correlational relationships between psychosocial variables. In addition, or in opposition, to employing empirical and deductive methods, some—especially

clinical and counseling psychologists—at times rely upon symbolic interpretation and other inductive techniques. Psychology has been described as a "hub science", with psychological findings linking to research and perspectives from the social sciences, natural sciences, medicine, humanities, and philosophy.
Psychology is also directed towards understanding and solving problems in several spheres of human activity. By many accounts psychology ultimately aims to benefit society (https://en.wikipedia.org/wiki/Psychology).

B. Sociology and Social Psychology

Sociology is the study of social behavior or society, including its origins, development, organization, networks, and institutions. It is a social science that uses various methods of empirical investigation and critical analysis to develop a body of knowledge about social order, disorder, and change. Many sociologists aim to conduct research that may be applied directly to social policy and welfare, while others focus primarily on refining the theoretical understanding of social processes. Subject matter ranges from the micro-sociology level of individual agency and interaction to the macro level of systems and the social structure (https://en.wikipedia.org/wiki/Sociology).

Social psychology is the scientific study of how people's thoughts, feelings, and behaviors are influenced by the actual, imagined, or implied presence of others. In this definition, scientific refers to the empirical method of investigation. The terms thoughts, feelings, and behaviors include all psychological variables that are measurable in a human being. The statement that others' presence may be imagined or implied suggests that we are prone to social influence even when no other people are present, such as when watching television, or following internalized cultural norms. Social psychologists typically explain human behavior as a result of the interaction of mental states and immediate social situations (https://en.wikipedia.org/wiki/Social_psychology).

C. Cognitive Science

Cognitive science is the interdisciplinary, scientific study of the mind and its processes. It examines the nature, the tasks, and the functions of cognition. Cognitive scientists study intelligence and behavior, with a focus on how nervous systems represent, process, and transform information. Mental faculties of concern to cognitive scientists include language, perception, memory, attention, reasoning, and emotion; to understand these faculties, cognitive scientists borrow from fields such as linguistics, psychology, artificial intelligence, philosophy, neuroscience, and anthropology. The typical analysis of cognitive science spans many levels of organization, from learning and decision to logic and planning; from neural circuitry to modular brain organization. The fundamental concept of cognitive science is that "thinking can best be understood in terms of representational structures in the mind and computational procedures that operate on those structures”. The

cognitive sciences began as an intellectual movement in the 1950s often referred to as the cognitive revolution (https://en.wikipedia.org/wiki/Cognitive_science).

D. Human Factors/ Cognitive Ergonomics/ Physical Ergonomics

Human factors and ergonomics (commonly referred to as **HF&E**), also known as comfort design, functional design, and systems, is the practice of designing products, systems, or processes to take proper account of the interaction between them and the people who use them.

The field has seen some contributions from numerous disciplines, such as psychology, engineering, biomechanics, industrial design, physiology, and anthropometry. In essence, it is the study of designing equipment, devices and processes that fit the human body and its cognitive abilities. The two terms "human factors" and "ergonomics" are essentially synonymous.

D.1. Physical Ergonomics

Physical ergonomics is concerned with human anatomy, and some of the anthropometric, physiological and bio mechanical characteristics as they relate to physical activity.[5] Physical ergonomic principles have been widely used in the design of both consumer and industrial products. Physical ergonomics is important in the medical field, particularly to those diagnosed with physiological ailments or disorders such as arthritis (both chronic and temporary) or carpal tunnel syndrome. Pressure that is insignificant or imperceptible to those unaffected by these disorders may be very painful, or render a device unusable, for those who are. Many ergonomically designed products are also used or recommended to treat or prevent such disorders, and to treat pressure-related chronic pain.

D.2. Cognitive Ergonomics

Cognitive ergonomics is concerned with mental processes, such as perception, memory, reasoning, and motor response, as they affect interactions among humans and other elements of a system. (Relevant topics include mental workload, decision-making, skilled performance, human reliability, work stress and training as these may relate to human-system and Human-Computer Interaction design.)

D.3. Organizational Ergonomics

Organizational ergonomics is concerned with the optimization of socio-technical systems, including their organizational structures, policies, and processes.[5] (Relevant topics include communication, crew resource management, work design, work systems, design of working times, teamwork, participatory design, community ergonomics, cooperative work, new work programs, virtual

organizations, telework, and quality management https://en.wikipedia.org/wiki/Human_factors_and_ergonomics).

E. Computer Science

Computer science is the study of the theory, experimentation, and engineering that form the basis for the design and use of computers. It is the scientific and practical approach to computation and its applications and the systematic study of the feasibility, structure, expression, and mechanization of the methodical procedures (or algorithms) that underlie the acquisition, representation, processing, storage, communication of, and access to information. An alternate, more succinct definition of computer science is the study of automating algorithmic processes that scale. A computer scientist specializes in the theory of computation and the design of computational systems. The two areas of computer science are theoretical computer science and applied computer science (https://en.wikipedia.org/wiki/Computer_science).

E.1. Computer Graphics

Computer graphics are pictures and films created using computers. Usually, the term refers to computer-generated image data created with help from specialized graphical hardware and software. It is a vast and recent area in computer science. The phrase was coined in 1960, by computer graphics researchers Verne Hudson and William Fetter of Boeing. It is often abbreviated as CG, though sometimes erroneously referred to as computer-generated imagery (CGI).

Some topics in computer graphics include user interface design, sprite graphics, vector graphics, 3D modeling, shaders, GPU design, implicit surface visualization with ray tracing, and computer vision, among others. The overall methodology depends heavily on the underlying sciences of geometry, optics, and physics.

Computer graphics is responsible for displaying art and image data effectively and meaningfully to the user. It is also used for processing image data received from the physical world. Computer graphic development has had a significant impact on many types of media and has revolutionized animation, movies, advertising, video games, and graphic design generally (https://en.wikipedia.org/wiki/Computer_graphics).

E.2. Artificial Intelligence

Artificial intelligence (AI) is intelligence exhibited by machines. In computer science, the field of AI research defines itself as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chance of success at some goal. Colloquially, the term "artificial intelligence" is applied when a machine mimics "cognitive" functions that humans associate with other human minds, such as "learning" and "problem solving".

As machines become increasingly capable, mental facilities once thought to require intelligence are removed from the definition. For instance, optical character recognition is no longer perceived as an example of "artificial intelligence", having become a routine technology.[3] Capabilities currently classified as AI include successfully understanding human speech,[4] competing at a high level in strategic game systems (such as chess and Go[5]), autonomous cars, intelligent routing in content delivery networks, military simulations, and interpreting complex data.
AI research is divided into subfields[6] that focus on specific problems, approaches, the use of a particular tool, or towards satisfying particular applications.

The central problems (or goals) of AI research include reasoning, knowledge, planning, learning, natural language processing (communication), perception and the ability to move and manipulate objects. General intelligence is among the field's long-term goals.[8] Approaches include statistical methods, computational intelligence, and traditional symbolic AI. Many tools are used in AI, including versions of search and mathematical optimization, logic, methods based on probability and economics. The AI field draws upon computer science, mathematics, psychology, linguistics, philosophy, neuroscience, artificial psychology and many others (https://en.wikipedia.org/wiki/Artificial_intelligence).

E.3. Computer Vision

Computer vision is an interdisciplinary field that deals with how computers can be made for gaining high-level understanding from digital images or videos. From the perspective of engineering, it seeks to automate tasks that the human visual system can do. "Computer vision is concerned with the automatic extraction, analysis and understanding of useful information from a single image or a sequence of images. It involves the development of a theoretical and algorithmic basis to achieve automatic visual understanding." As a scientific discipline, computer vision is concerned with the theory behind artificial systems that extract information from images. The image data can take many forms, such as video sequences, views from multiple cameras, or multi-dimensional data from a medical scanner. As a technological discipline, computer vision seeks to apply its theories and models for the construction of computer vision systems (https://en.wikipedia.org/wiki/Computer_vision).

F. Visualization

Visualization or visualisation is any technique for creating images, diagrams, or animations to communicate a message. Visualization through visual imagery has been an effective way to communicate both abstract and concrete ideas since the dawn of humanity. Examples from history include cave paintings, Egyptian

hieroglyphs, Greek geometry, and Leonardo da Vinci's revolutionary methods of technical drawing for engineering and scientific purposes.

Visualization today has ever-expanding applications in science, education, engineering (e.g., product visualization), interactive multimedia, medicine, etc. Typical of a visualization application is the field of computer graphics. The invention of computer graphics may be the most important development in visualization since the invention of central perspective in the Renaissance period. The development of animation also helped advance visualization (https://en.wikipedia.org/wiki/Visualization_(graphics).

G. Design

The creation of a plan or convention for the construction of an object, system or measurable human interaction (as in architectural blueprints, engineering drawings, business processes, circuit diagrams, and sewing patterns). Design has different connotations in different fields (see design disciplines below). In some cases, the direct construction of an object (as in pottery, engineering, management, coding, and graphic design) is also considered to use design thinking.
Designing often necessitates considering the aesthetic, functional, economic, and sociopolitical dimensions of both the design object and design process. It may involve considerable research, thought, modeling, interactive adjustment, and re-design. Meanwhile, diverse kinds of objects may be designed, including clothing, graphical user interfaces, skyscrapers, corporate identities, business processes, and even methods or processes of designing (https://en.wikipedia.org/wiki/Design).

G.1. Industrial Design

Industrial design is a process of design applied to products that are to be manufactured through techniques of mass production. Its key characteristic is that design is separated from manufacture: the creative act of determining and defining a product's form and features takes place in advance of the physical act of making a product, which consists purely of repeated, often automated, replication.[4][5] This distinguishes industrial design from craft-based design, where the form of the product is determined by the product's creator at the time of its creation (https://en.wikipedia.org/wiki/Industrial_design).

G.2. Design Graphics and Aesthetics

Graphic design is the process of visual communication and problem-solving using one or more of typography, photography and illustration. The field is considered a subset of visual communication and communication design, but sometimes the term "graphic design" is used synonymously. Graphic designers create and combine symbols, images and text to form visual representations of ideas and messages. They use typography, visual arts

and page layout techniques to create visual compositions. Common uses of graphic design include corporate design (logos and branding), editorial design (magazines, newspapers and books), wayfinding or environmental design, advertising, web design, communication design, product packaging and signage (https://en.wikipedia.org/wiki/Graphic_design).

Aesthetics is a branch of philosophy that explores the nature of art, beauty, and taste, with the creation and appreciation of beauty.
In its more technically epistemological perspective, it is defined as the study of subjective and sensori-emotional values, sometimes called judgements of sentiment and taste. More broadly, scholars in the field define aesthetics as "critical reflection on art, culture and nature". In modern English, the term aesthetic can also refer to a set of principles underlying the works of a particular art movement or theory: one speaks, for example, of the Cubist aesthetic (https://en.wikipedia.org/wiki/Aesthetics).

G.3. Information Design
Information design is the practice of presenting information in a way that fosters efficient and effective understanding of it. The term has come to be used specifically for graphic design for displaying information effectively, rather than just attractively or for artistic expression. Information design is closely related to the field of data visualization and is often taught as part of graphic design courses. It is an explanation design. It explains facts of the world and leads to knowledge and informed action (https://en.wikipedia.org/wiki/Information_design).

G.4. Interaction Design
Interaction design, often abbreviated as IxD, is "the practice of designing interactive digital products, environments, systems, and services. While the digital side of this statement is true, interaction design is also useful when creating physical (non-digital) products, exploring how a user might interact with it. Common topics of interaction design include design, human–computer interaction, and software development. While interaction design has an interest in form (similar to other design fields), its main area of focus rests on behavior. Rather than analyzing how things are, interaction design synthesizes and imagines things as they could be. This element of interaction design is what clearly marks IxD as a design field as opposed to a science or engineering field. While disciplines such as software engineering have a heavy focus on designing for technical stakeholders, interaction design is geared toward satisfying the majority of users (https://en.wikipedia.org/wiki/Interaction_design).

G.5. Process Centered Design
Process-centered design (PCD) is a design methodology, which proposes a business centric approach for designing user interfaces. Because of the

multi-stage business analysis steps involved right from the beginning of the PCD life cycle, it is believed to achieve the highest levels of business-IT alignment that is possible through UI (https://en.wikipedia.org/wiki/Process-centered_design).

G.6. Sonic – Interaction Design

Sonic interaction design is the study and exploitation of sound as one of the principal channels conveying information, meaning, and aesthetic/emotional qualities in interactive contexts. Sonic interaction design is at the intersection of interaction design and sound and music computing. If interaction design is about designing objects people interact with, and such interactions are facilitated by computational means, in sonic interaction design, sound is mediating interaction either as a display of processes or as an input medium.

H. Information Security

Information security, sometimes shortened to InfoSec, is the practice of preventing unauthorized access, use, disclosure, disruption, modification, inspection, recording or destruction of information. It is a general term that can be used regardless of the form the data may take (e.g. electronic, physical) (https://en.wikipedia.org/wiki/Information_security).

H.1. HCISec.

The study of interaction between humans and computers, or human–computer interaction, specifically as it pertains to information security. Its aim, in plain terms, is to improve the usability of security features in end user applications.

Unlike HCI, which has roots in the early days of Xerox PARC during the 1970s, HCISec is a nascent field of study by comparison. Interest in this topic tracks with that of Internet security, which has become an area of broad public concern only in very recent years. When security features exhibit poor usability, the following are common reasons:

- they were added in casual afterthought
- they were hastily patched in to address newly discovered security bugs
- they address very complex use cases without the benefit of a software wizard
- their interface designers lacked understanding of related security concepts
- their interface designers were not usability experts (often meaning they were the application developers themselves (https://en.wikipedia.org/wiki/Human%E2%80%93computer_interaction_(security)

I. Speech Language Pathology

Speech-language pathology is a field of expertise practiced by a clinician known as a speech-language pathologist (SLP), also called speech and language therapist, or speech therapist, who specializes in the evaluation, diagnosis, and treatment of communication disorders, cognition, voice disorders, and swallowing disorders.

A common misconception is that speech-language pathology is restricted to correcting pronunciation difficulties, such as helping English speaking individuals enunciate their "s" and "r" sounds, and helping people who stutter to speak more fluently. In fact, speech-language pathology is concerned with a broad scope of speech, language, swallowing, and voice issues involving communication, some of which are:

- Word-finding issues, either as a result of a specific language problem such as a language delay or a more general issue such as dementia.
- Social communication difficulties involving how people communicate ideas with others (pragmatics).
- Structural language impairments, including difficulties creating sentences that are grammatical (syntax) and meaningful (semantics).
- Literacy impairments (reading and writing) related to the letter-to-sound relationship (phonics), the word-to-meaning relationship (semantics), and understanding the ideas presented in a text (reading comprehension).
- Voice difficulties, such as a raspy voice, a voice that is too soft, or other voice difficulties that negatively impact a person's social or professional performance.
- Cognitive impairments (e.g., attention, memory, executive function) to the extent that they interfere with communication.

The components of speech production include:

- phonation (producing sound);
- resonance;
- fluency;
- Intonation,
- Pitch variance;
- Voice (including aeromechanical components of respiration)

The components of language include:

- phonology (manipulating sound according to the rules of a language);
- Morphology (understanding and using minimal units of meaning);
- syntax (constructing sentences according to languages' grammar rules);
- semantics (interpreting signs or symbols of communication to construct meaning);
- pragmatics (social aspects of communication).

(https://en.wikipedia.org/wiki/Speech-language_pathology)

J. Personal Information Management

Personal information management (PIM) is the activities people perform in order to acquire, organize, maintain, retrieve and use personal information items such as documents (paper-based and digital), web pages and email messages for everyday use to complete tasks (work-related or not) and fulfill a person's various roles (as parent, employee, friend, member of community, etc.). More simply, *PIM is the art of getting things done in our lives through information.* A recent review and conceptual framework for PIM is provided.

Practically, PIM is concerned with how people organize and maintain personal information collections, and methods that can help people in doing so. People may manage information in a variety of settings, for a variety of reasons, and with a variety of types of information. For example, an office worker might manage physical documents in a filing cabinet by placing them in folders organized alphabetically by project name, or might manage digital documents in folders in a hierarchical file system. A parent might collect and organize photographs of their children into a photo album using a temporal organization scheme, or might tag digital photos with the names of the children.

PIM considers not only the methods used to store and organize information, but also is concerned with how people retrieve information from their collections for re-use. For example, the office worker might re-locate a physical document by remembering the name of the project and then finding the appropriate folder by an alphabetical search. On a computer system with a hierarchical file system, a person might need to remember the top-level folder in which a document is located, and then browse through the folder contents to navigate to the desired document. Email systems often support additional methods for re-finding such as fielded search (e.g., search by sender, subject, date). The characteristics of the document types, the data that can be used to describe them (meta-data), and features of the systems used to store and organize them (e.g. fielded search) are all components that may influence how users accomplish personal information management.
Studying, understanding, and practicing PIM can help individuals and organizations work more effectively and efficiently, can help people deal with "information overload", and can highlight useful strategies for archiving, organizing, and facilitating access to saved information.

There are six ways in which information can be personal:[1]

1. Owned by "me"
2. About "me"
3. Directed toward "me"
4. Sent/Posted by "me"
5. Experienced by "me"
6. Relevant to "me"

One ideal of PIM is that people should always have the right information in the right place, in the right form, and of sufficient completeness and quality to meet their current need. Technologies and tools such as personal information managers help people spend less time with time-consuming and error-prone activities of PIM (such as looking for and organising information). They then have more and better insight in making creative, intelligent use of their time, or to simply enjoy the information itself (https://en.wikipedia.org/wiki/Personal_information_management).

K. Phenomenology

Phenomenology (from Greek *phainómenon* "that which appears" and *lógos* "study") is the philosophical study of the structures of experience and consciousness. As a philosophical movement it was founded in the early years of the 20th century by Edmund Husserl and was later expanded upon by a circle of his followers at the universities of Göttingen and Munich in Germany. It then spread to France, the United States, and elsewhere, often in contexts far removed from Husserl's early work.

Phenomenology should not be considered as a unitary movement; rather, different authors share a common family resemblance but also with many significant differences. Accordingly:

A unique and final definition of phenomenology is dangerous and perhaps even paradoxical as it lacks a thematic focus. In fact, it is not a doctrine, nor a philosophical school, but rather a style of thought, a method, an open and ever-renewed experience having different results, and this may disorient anyone wishing to define the meaning of phenomenology.

Phenomenology, in Husserl's conception, is primarily concerned with the systematic reflection on and study of the structures of consciousness and the phenomena that appear in acts of consciousness. Phenomenology can be clearly differentiated from the Cartesian method of analysis which sees the world as objects, sets of objects, and objects acting and reacting upon one another.

Teaching Delivery (TLAs):

- Lecture and Class Discussion (Synchronous and Asynchronous)

Assessment:

Assignment No. 1. Research a company and list or explain the technology/science they relate to and what are the Human Computer Interaction related things they are using. Write your answer in letter size word document and wait for the instruction where to pass.

Reference:

- https://en.wikipedia.org/wiki/Outline_of_human%E2%80%93computer_interaction#Styles_of_human.E2.80.93computer_interaction