

Review on Human Computer Interaction

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Abstract: *In the field of artificial intelligence, human computer interaction(HCI) technology and its related intelligent robot technologies are essential and interesting contents of research. From the perspective of software algorithm and hardware system, we try to build a natural HCI environment. Human Computer Interaction(HCI) has been challenged in recent years because of advanced technology requiring adoption of new applications and investigations of connection with other disciplines ,to enhance its theoretical knowledge.*

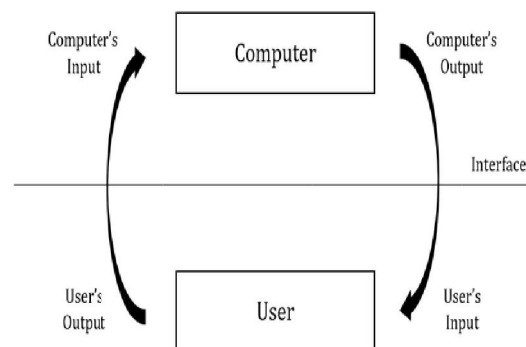


Figure: User Computer Interaction

Keywords: Human-Computer Interaction.

I. INTRODUCTION

Human-computer interaction (HCI) has been considered as computer-related cross-disciplinary domain that is strongly associated with design for information, interaction, and communication and technology. Researchers in HCI are frequently involved in designing research prototypes based on theories from the cognitive and social sciences, anthropology, and sociology in addition to computer science. They equally focus on HCI research and the analytic approaches and techniques in design practice. However, there is a lack of clarity regarding the nature of design processes involved in this influential field and the role of design and design thinking in HCI research and practice.

HCI education and practice have been facing many challenges triggered by the rapid advancement of technology. Fast changing interface and interaction systems require new processes that allow for rapidly developed designs, evaluations, and interaction strategies facilitating efficient and unique user interactions with computer systems.

Design thinking (DT) has gained increased interest in the past decade. According to Brown , DT is a “human-centered, creative, iterative, and practical approach to finding the best ideas and ultimate solutions” with innovative activities, proving itself as an effective strategy for organizational changes. These characteristics allow DT to be used widely in diverse contexts as well as creating and making choices. Also, DT allows involving various disciplines to address complex problems and enhance user experience emphasizing human values.

II. WHAT IS HUMAN-COMPUTER INTERACTION?

Human-computer interaction (HCI) is a straightforward topic. There is always someone who wants to accomplish something, such as write an essay or fly an aero plane. Incorporating a mediating computer into the action is what distinguishes it as HCI. In theory, our human might have completed the assignment without the assistance of the computer. She may have written with a quill pen and ink, for example, or flown an aero plane with hydraulic controls. These aren't quite HCI. They do make use of intermediary tools or devices, and the design process and realities of their

usage are similar to those of HCI. In reality, they fall under the umbrella of HCI's uncle discipline, human factors. However, it is the computer, as well as the process of contingent interaction the computer renders possible, that makes HCI distinctive.

The computer can change how a task is represented and what abilities are required. It has the potential to transform the linear writing process into something more like to sculpting, with the writer roughing out the entire text before adding or deleting sections to enhance it. It may turn piloting into a type of supervision, allowing the computer to conduct the real flying using inputs of speed, altitude, and position and outputs of throttle, flap, and rudder. And if we have a small group or a large crowd instead of a single person, or if we have a network of communicating mobile or embedded computers instead of a single computer, or if we have impinging cultural or coordination considerations instead of a simple task, we get the many variants of computer mediation that form the broad spectrum of HCI.

The components of an HCI discipline appear to be straightforward as well. There is a piece of software that has to be developed and implemented. There's the design process for the interaction itself, as well as the virtual or actual items with which to engage. Then there are all the HCI concepts, abstractions, ideas, facts, and phenomena to be aware of. Let's name the first one interaction engineering (e.g., using Harelstatecharts to guide implementation), the second interaction design (e.g., designing a workflow for a smartphone to track diet), and the third interaction science (e.g., using Fitts' law to determine button sizes in an application). The difficult part for HCI is putting these three pieces together. Beside work in HCI itself, each has its own literature not friendly to outsiders.

III. WHY IS HCI IMPORTANT?

At least three causes exist. First, having a theory allows for explanatory assessment. If you don't know why there was a difference, you can't use A-B testing. You can, on the other hand, correct it if you have a theory that allows you to comprehend the difference. If you don't comprehend why a windows-based user interface might take an excessive amount of time to use, you'll never be able to undertake usability testing, for example, if you don't understand the theoretical idea of the window working set.

It also allows for generative design. It allows for a change in how the design space is represented. When it is discovered that the bandwidth of the human motor group to which a transducer will be applied is a critical attribute of pointing devices, the challenge is framed in terms of how to link those muscles and the implications for the remainder of the design. Third, it promotes knowledge codification. We can only concisely cumulate our data and construct a field with adequate power and depth if we have theories and abstractions.

HCI is essential since it will enable items to be more successful, safe, useful, and functional. In the long run, it will make the user's experience more delightful. As a result, having someone with HCI expertise involved in all stages of product or system development is essential. HCI is also required to avoid items or projects from entirely failing. HCI is crucial for building clear intuitive systems that can be used by people with a wide range of abilities and expertise, as well as those who have not completed any formal training. By utilizing our everyday understanding of the environment, HCI makes software and devices more understandable and beneficial for everyone.

Because everyone has used actual paper folders in their everyday lives, showing a visual of a little folder in a computer's interface aids the user in understanding the folder's function. Finally, if a system is well-designed utilizing HCI methods, the user should not have to be concerned about the system's complexity. The norm should be clear, transparent, and natural engagement.

HCI is critical since it will be necessary for goods to be more successful, safe, helpful, and functional. It will make the user's experience more enjoyable in the long term. As a result, having someone with HCI skills involved in all phases of any product or system development is critical. HCI is also quality. Furthermore, it is observed that when the design methods used in the scope of human-computer interaction are integrated into software development process during the life cycle, the developed projects are more successful, have better quality and are more user friendly.

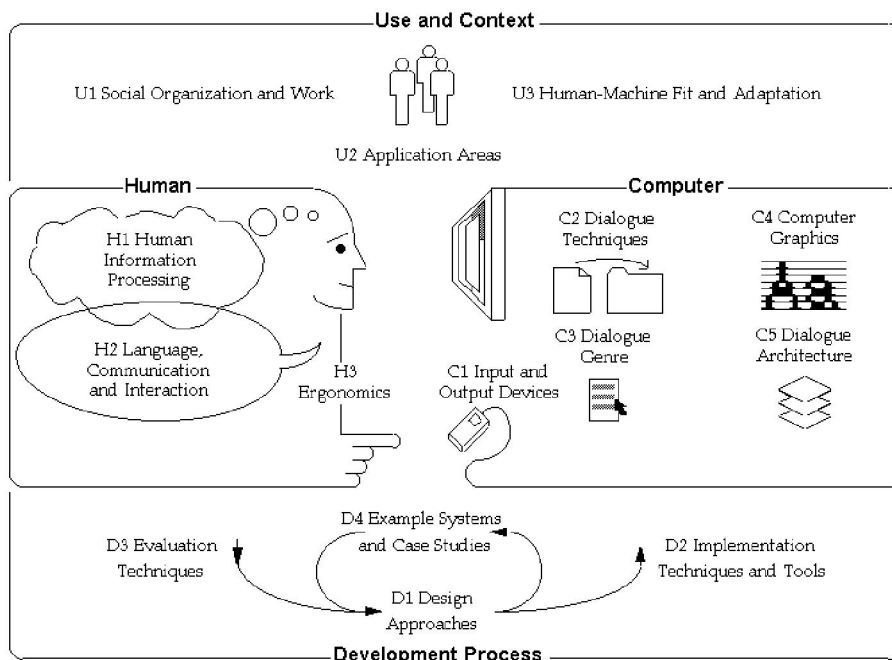


Figure 2: HCI development

IV. HCI DESIGN PROCESS

Ebert outlined four human-computer interaction design principles that may be applied to user interface designs to create a user-friendly, systematic, and intuitive experience for users. In a single user interface design, one or more techniques might be employed. The following are the four techniques to designing a user interface:

1. **Anthropomorphic Approach:** This method entails creating a human interface with human-like qualities.
2. **Cognitive Approach:** This method is used to create a user interface that helps the end user and takes into account the brain's and sensory recognition skills.
3. **Empirical Methodology:** This method is used to evaluate and compare the usability of multi-conceptual designs.
4. **Predictive Modeling Approach:** The GOMS technique examines and considers a user's experience in terms of the time it takes to fulfil a goal efficiently and effectively. GOMS stands for goals, operators, methods, and section rules, with g for goals, o for operators, m for methods, and s for section rules. The time it takes a human to achieve a specific objective is calculated using precise measures of that individual's performance.

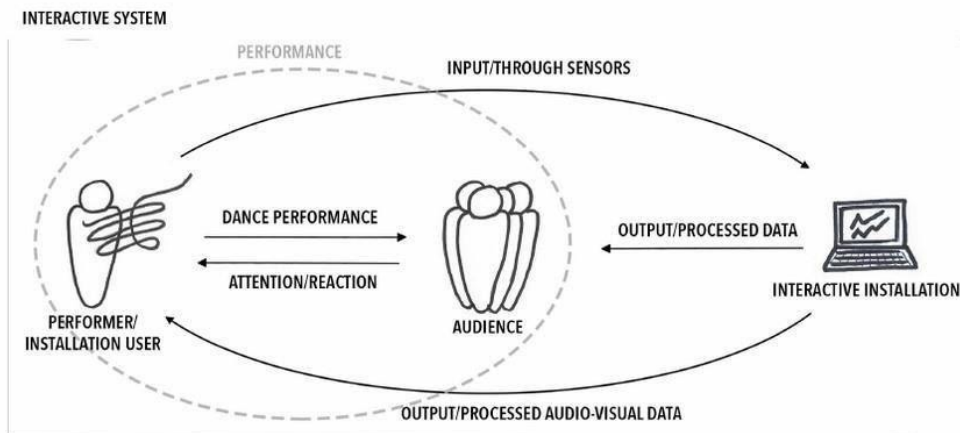


Figure 3: Interaction between human and computer

V. EXISTING HCI TECHNOLOGIES

HCI design should take into account a wide range of human behaviors and be practical. When compared to the simplicity of the interaction technique itself, the degree of human engagement in connection with a computer is sometimes imperceptible. The complexity of current interfaces varies depending on the degree of functionality/usability as well as the financial and commercial aspects of the machine on the market. An electrical kettle, for example, does not require a complicated user interface because its sole purpose is to heat water, and it would be impractical to have anything more than a thermostatic on/off button. A basic website, on the other hand, with limited functionality, should have a complex enough usability to attract and retain consumers.

As a result, while designing HCI, the amount of interaction a user has with a machine should be carefully considered. There are three levels of user activity: physical, cognitive, and emotive. The physical aspect establishes the mechanics of human-computer interaction, whereas the cognitive aspect addresses how users can comprehend and participate with the system. The emotive element is a relatively recent concern, and it aims to impact the user in such a manner that they continue to use the computer by influencing attitudes and feelings toward the user.

Recent HCI approaches and technologies are attempting to blend traditional means of interaction with newer technology like as networking and animation. Wearable gadgets, wireless devices, and virtual devices are the three categories of new innovations. Technology is progressing at such a rapid pace that the distinctions between these new technologies are blurring and merging. GPS navigation systems, military super-soldier enhancing devices (e.g. thermal vision, tracking other soldiers' movements using GPS, and environmental scanning), radio frequency identification (RFID) products, personal digital assistants (PDAs), and virtual tours for real estate businesses are just a few examples of these devices. Some of the new gadgets improved and merged prior interface methods.

VI. RECENT ADVANCES IN HCI

In following sections, recent directions and advances of research in HCI, namely intelligent and adaptive interfaces and ubiquitous computing, are presented. These interfaces involve different levels of user activity: physical, cognitive, and affection.

6.1 Intelligent and Adaptive HCI

Although the bulk of the public's gadgets are still simple command/action setups with less complex physical gear, the flow of research is focused on the development of intelligent and adaptable interfaces. The precise theoretical meaning of intelligence or being clever is unknown or, at the very least, not publicly acceptable. However, the apparent increase and improvement in functionality and usefulness of new technologies on the market may be used to describe these ideas.

Differentiating between employing intelligence in the creation of the interface (Intelligent HCI) and the way the interface interacts with users is a key aspect in the next generation of interfaces (Adaptive HCI). Intelligent HCI designs are user interfaces that include intelligence in their perception and/or reaction to users. Speech-enabled interfaces that engage with users using natural language and gadgets that visually detect the user's motions or gaze.

Adaptive HCI designs, on the other hand, may not employ intelligence in the interface design but do so in the way they interact with users in the future. An example of adaptable HCI is a website that sells numerous things using a standard GUI. This website would be adaptable -to a degree- if it could identify the user and remember his searches and purchases, as well as intelligently search, discover, and propose things on sale that it believes the user would require. The majority of these adaptations are concerned with cognitive and emotive levels of user involvement.

Finally, when it comes to intelligent interfaces, it's important to remember that most non-intelligent HCI designs are passive in nature, meaning they only respond when the user invokes them, whereas ultimate intelligent and adaptable interfaces are active interfaces. Smart billboards or adverts, for example, show themselves based on the preferences of consumers. In the following part, we'll look at how combining different HCI methodologies might aid in the creation of intelligent adaptable natural interfaces.

6.2 Ubiquitous Computing and Ambient Intelligence

The most recent research in the realm of human-computer interaction is undeniably pervasive computing (UbiComp). The term, which is often interchangeably used with ambient intelligence and pervasive computing, refers to the

ultimate methods of human-computer interaction, which is the deletion of a desktop and embedding of the computer in the environment, so that it is invisible to humans while surrounding them everywhere, hence the term ambient.

Mark Weiser, then the head technologist of Xerox PARC's Computer Science Lab, was the first to develop the concept of ubiquitous computing in 1998. His concept was to embed computers into the environment and ordinary things so that people might interact with several computers at the same time while remaining unseen to them and connecting wirelessly. Ubicomp has also been named the Third Wave of computing. The First Wave was the mainframe era, many people one computer. Then it was the Second Wave, one person one computer which was called PC era and now Ubicomp introduces many computers one person era.

A. Interaction Devices

As computers are adapted for diverse tasks, from control of industrial processes to art and design, they are being fitted with interaction devices which enable objects on the screen to be created, selected, oriented, tracked, and moved. New input devices include trackballs, Data Gloves, eye trackers, digitalizing tablets and thumb-wheels. The keyboard is still the main method of providing data to a computer, but the design of keyboards is changing to address and can split concerns about fatigue and 'repetitive strain injury'. Some new keyboards include wrist supports down the center, so that each half can be swung outwards to keep the hand in a comfortable position.

VII. APPLICATIONS OF HCI

In day today Life

- Today, technology has infiltrated every area of our life.
- Even if a person does not directly own or use a computer, computers have an impact on their lives.
- ATM machines, railway ticket selling machines, and hot beverage vending machines are just a few examples of computer interfaces that people may interact with on a regular basis without having to possess a computer.
- When creating any of these systems or interfaces, human-computer interaction is crucial, whether designing an interface for an ATM or a desktop computer.
- HCI principles should be examined and taken into account to guarantee that the interface is safe, useful, and efficient.

Users who are untrained

- Today, only a small percentage of computer users read the software's documentation, assuming one exists.
- Only the most specialist and complex programmes need intensive training and a handbook. Within a few minutes of engaging with a computer software, consumers expect to grasp its basic features.
- HCI equips designers with the ideas, strategies, and resources they need to create intuitive, easy-to-use interfaces that don't require training.

Industry and Business

HCI is significant for any company that relies on technology or computers in its day-to-day operations. Staff are more content and productive when working with well-designed usable systems since they are not irritated.

HCI is particularly essential in the design of safety-critical systems like those found in power plants and air traffic control centres. In these instances, design flaws can have catastrophic consequences, including the death of many individuals.

Scientific Fragmentation

HCI has been a successful technological and scientific undertaking. It achieved an effective integration of software engineering and the human factors of computing systems through the concepts and methods of cognitive science. In doing so, it helped to broaden and develop cognitive science itself. No one could have anticipated in 1980 just how HCI would develop. And we cannot know its future course now. However, the progress of the past two decades highlights specific current challenges.

VIII. ACCESSIBILITY

When building systems that are not just functional but also accessible to persons with impairments, human-computer interaction is a critical factor to consider. HCI's basic idea is to offer everyone with secure, usable, and efficient systems, which includes people with a wide variety of abilities and levels of experience and knowledge. Any system that is built using HCI user-centered approaches and necessary to prevent goods or projects from failing completely. When creating clear intuitive systems that will be accessible by people with a wide variety of talents and knowledge, as well as those who have not finished any official training, HCI is critical. HCI makes software and gadgets more intelligible and useful for everyone by leveraging our everyday knowledge of the environment. As everyone has used genuine paper folders in their daily lives, displaying a visual of a small folder in a computer's interface helps the user comprehend the folder's purpose. Finally, if a system is well-designed using HCI approaches, the user should not have to worry about the system's complexities. Clear, straightforward, and natural interaction should be the

Today, software industry has a rapid growth. In order to resist the competition increased by this growth, software projects need to be developed with higher quality and especially user friendly. Therefore, the importance of human-computer interaction emerges clearly. In design and development phases of software projects, the properties of human which is an important agent for interaction -- such as behavioral, cognitive, perceptive, efficiency and physical factors have to be considered. This study aims to express the importance of developing softwares by taking into consideration the human-computer interaction applications. In this context, firstly a wide literature review is made to examine software development process and human-computer interaction in detail, the results obtained by using design methods in this process are explicated and the importance of said interaction is openly expressed with the exemplary applications in the literature. According to the results of the research, especially in software life cycle, it is observed that rules of interaction must be implemented before software development, however, these methods are usually included in software life cycle in the latter stages of software development process. This situation causes the developed softwares to be user unfriendly.

IX. CONCLUSION

Human-computer interaction (HCI) as a topic is basically simple. There is a person of some sort who wants to do some task like write an essay or pilot an airplane. What makes the activity HCI is inserting a mediating computer. In principle, our person could have done the task without the computer. She could have used a quill pen and ink, for example, or flown an airplane that uses hydraulic tubes to work the controls. These are not quite HCI. They do use intermediary tools or machines, and the process of their design and the facts of their use bear resemblance to those of HCI. In fact, they fit into HCI's uncle discipline of human factors. But it is the computer, and the process of contingent interaction the computer renders possible, that makes HCI distinctive.

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