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HUMAN COMPUTER INTERACTION

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Abstract: Human-Computer Interaction, abbreviated HCI, has simply been explained as the study of how people interact with computing technology. It is the intersection between psychology and the social sciences, on the one hand, and computer science and technology, on the other. Throughout the past two decades HCI researchers have been analyzing and designing specific user interface technologies, studying and improving the processes of technology development and developing and evaluating new applications of technology with the aim of producing software and hardware that are useful, usable and artistic. This led to development of a body of technical knowledge and methodology. Psychologists have made numerous efforts to understand in detail the involvement of cognitive, perceptual and motor components in the moment-by-moment interaction a person encounters when working at a computer. This line of work was started by Card et al. (1983). Their research was based on the separation of computer use knowledge from what operates on the knowledge to derive a specific behavior with this approach it was claimed that one could determine several important behaviors. Later a number of researchers built on this original work, adding ore to it. The most significant addition to this was Kieras and Meyer (1997) with their popular 'EPIC'. Cognitive modeling has also been quite practical. Gray et al. (1993), for example, applied it to the evaluation of two telephone operator keyboards predicting and confirming enacting times between the two. Others have applied it to the application designs like CAD for the banking and Engineering sectors. Although this model has been said to be very powerful, it's application is not universal. That brings us to the second line of theoretical research; Distributed Cognition.

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1. INTRODUCTION

Human–computer Interaction (**HCI**) involves the study, planning, and design of the interaction between people (users) and computers. It is often regarded as the intersection of computer science, behavioral sciences, design and several other fields of study. The term was popularized by Card, Moran, and Newell in their seminal 1983 book, "The Psychology of Human-Computer Interaction", although the authors first used the term in 1980, and the first known use was in 1975. The term connotes that, unlike other tools with only limited uses (such as a hammer, useful for driving nails, but not much else), a computer has many affordances for use and this takes place in an open-ended dialog between the user and the computer. Because 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, 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, and human factors such as computer user satisfaction 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)**.The computing industry has been encouraged to increase it expenditure on HCI by large research programmes. These programmes have often funded joint collaborative projects between computer companies and academic institutions. Consequently, the strengthened links between academia and industry, together with the expansion in the numbers of researchers concerned with HCI, have led to a considerable growth in the numbers of HCI conferences, seminars and workshops

Research in Human-Computer Interaction (HCI) has been spectacularly successful, and has fundamentally changed computing. Just one example is the ubiquitous graphical interface used by Microsoft Windows 95, which is based on the Macintosh, which is based on work at Xerox PARC, which in turn is based on early research at the Stanford Research Laboratory (now SRI) and at the Massachusetts Institute of Technology. Another example is that virtually all software written today employs user interface toolkits and interface builders, concepts which were developed first at universities. Even the spectacular growth of the

World-Wide Web is a direct result of HCI research: applying hypertext technology to browsers allows one to traverse a link across the world with a click of the mouse. Interface improvements more than anything else has triggered this explosive growth. Furthermore, the research that will lead to the user interfaces for the computers of tomorrow is happening at universities and a few corporate research labs.

This paper tries to briefly summarize many of the important research developments in Human-Computer Interaction (HCI) technology. By "research," I mean exploratory work at universities and government and corporate research labs (such as Xerox PARC) that is not directly related to products. By "HCI technology," I am referring to the computer side of HCI. A companion article on the history of the "human side," discussing the contributions from psychology, design, human factors and ergonomics would also be appropriate.

A motivation for this article is to overcome the mistaken impression that much of the important work in Human-Computer Interaction occurred in industry, and if university research in Human-Computer Interaction is not supported, then industry will just carry on anyway. This is simply not true. This paper tries to show that many of the most famous HCI successes developed by companies are deeply rooted in university research. In fact, virtually all of today's major interface styles and applications have had significant influence from research at universities and labs, often with government funding. To illustrate this, this paper lists the funding sources of some of the major advances. Without this research, many of the advances in the field of HCI would probably not have taken place, and as a consequence, the user interfaces of commercial products would be far more difficult to use and learn than they are today

2. HUMAN COMPUTER INTERACTION: A BRIEF HISTORY:

Human Computer Interaction(HCI) is an area of research and practice that emerged in the late 1970s and early 1980s, initially as an area in Computer Science. HCI has expanded rapidly and steadily for three decades, attracting professionals from many other disciplines and incorporating diverse concepts and approaches.

1970s- The rise of the Personal Computer.

The broad project of cognitive science, which incorporated cognitive psychology, artificial intelligence, linguistics, cognitive anthropology, and the philosophy of mind, had formed at the end of the 1970s.

1980s- Graphical User Interface (GUI).

Graphical User Interface (GUI) is the interface that is designed for the easier understanding of the users of the computers. Before GUI, there was a command prompt by which command was given to the computers. GUI started the graphical interface which is easy to use, understand, visualize, and it improved the working environment.

1990s- The Internet and Collaborative works.

The Internet started journey in 1990s. So, communications among people became easier. In the consequence of this, many new technologies arrived for better communication.

2000s- Mobile Computing and Beyond.

Mobile phones, PDA (Personal Development Assistance), and Smart Phones are ruling the present world. They offer a wide range of services to the people such as sms, mms, multimedia, games, email, internet, chatting, video conference, GPS etc.

Now a days the HCI is used in the area of Cognitive Science. With the help of the Internet, medical facilities can be provided remotely. Different interactive interfaces are designed those can be used for the cognitive rehabilitations.

3. GOALS:

A basic goal of HCI 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:

- methodologies and processes for designing interfaces (i.e., given a task and a class of users, design the best possible interface within given constraints, optimizing for a desired property such as learnability or efficiency of use)
- methods for implementing interfaces (e.g. software toolkits and libraries; efficient algorithms)
- techniques for evaluating and comparing interfaces
- developing new interfaces and interaction techniques
- developing descriptive and predictive models and theories of interaction

A 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 the user's task.

Professional practitioners in HCI are usually designers concerned with the practical application of design methodologies to real-world problems. Their work often revolves around designing graphical user interfaces and web interfaces.

Researchers in HCI are interested in developing new design methodologies, experimenting with new hardware devices, prototyping new software systems, exploring new paradigms for interaction, and developing models and theories of interaction.

4. INTERFACE DESIGN:

Many information technology interfaces are poorly designed. Many people are not able to use interfaces effectively due to poor design. Good interface design is important for reducing costs, errors, additional training, and employee turnover; and increasing user satisfaction, productivity, and quality products and services.

Good interface design requires diverse knowledge of systems design processes and user characteristics, including:

- Users' physical characteristics, limitations, and disabilities.
- Speed and efficiency needs.
- Reliability issues.
- Security concerns.
- Level of usability and functionality required.
- Frequency of product use.
- Users' past experience with same or similar product.
- Level of cognitive or mental effort required from the user.
- Users' tolerance for error.
- Users' patience and motivation for learning.
- Cultural and language aspects.

4.1. Good Interface Design

Good interface design requires diverse knowledge of systems design processes and user characteristics, including:

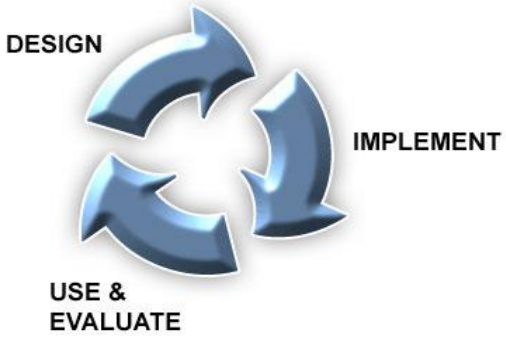
- Users' physical characteristics, limitations, and disabilities: Interface designers need to understand the characteristics of their users. For example, an Automatic Teller Machine (ATM) interface must be accessible by elderly, young, and disabled bank customers.

- Speed and efficiency needs: Many interfaces need to be quickly accessible and effective. For example, military pilots must have cockpit interfaces that allow quick and efficient interaction.
- Reliability issues: Interfaces that affect human lives need to provide reliable and readable information. For example, if an interface is provided information in a nuclear power plant system or a hospital operating room, the data quality and presentation needs to be accurate and reliable.
- Security concerns: Interfaces must have effective security and access mechanisms as required by an organization. For example, a bank Automatic Teller Machine (ATM) must allow bank customers to securely access their accounts and also keep out potential hackers.
- Level of usability and functionality required: Interfaces for users with little computing experience are more simply structured than interfaces designed for expert level users. For example, many interfaces offer advanced options and features for more expert users.
- Frequency of product use - Interfaces in high use computer systems need to be more reliable and effective to cater for fast interaction and a variety of users. For example, a bank Automatic Teller Machine (ATM) is used by hundreds of customers every day. The interface must allow for quick and effective interaction.
- Users' past experience with same or similar product - Many interfaces and systems provide similar features. For example, many bank Automatic Teller Machines (ATMs) provide identical functions and use similar banking terminology. The concepts of "withdrawal" and "deposit" that appear on ATM interfaces are familiar to bank users.
- Level of cognitive or mental effort required from the user - Many complex computer packages require a high level of financial or accounting knowledge. For example, the interface to the Quicken software requires knowledge of financial practices and accounting methods.
- Users' tolerance for error - Many interfaces allow users to complete actions with serious consequences when errors occur. For example, in a hospital emergency

room, the medical computer interfaces need to be accurate, reliable, and without error, or patients may die.

- Users' patience and motivation for learning - Many interfaces are designed to allow users effective interaction with little learning required. For example, bank Automatic Teller Machines (ATMs) are simple menu systems that are designed to allow quick and easy learning.
- Cultural and language aspects - Interface designers must take account of users' cultural and language differences. For example, many interfaces that are designed for users in the multicultural United States society provide interaction in English, Spanish, Chinese, or other languages.

4.2. User Centered Design

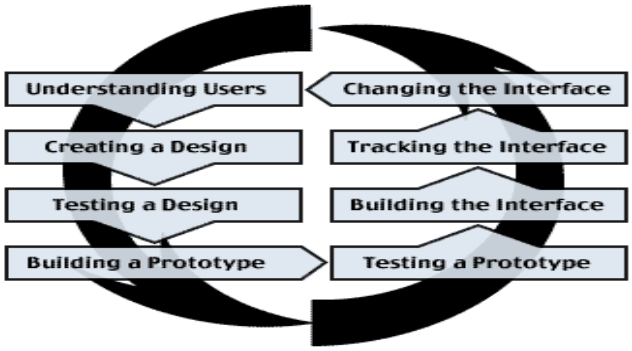


User centered participatory design involves the inclusion of users input into each phase of the user centered design process, including the user walkthrough and approval of each interface feature of a systems prototype.

User centered design involves the identification and consideration of relevant human factors in the design, evaluation, and implementation of information technology interfaces.

Displays should be readable (consider size, position, and ambient lighting) with differentiate and consistent displays (by shape, color, position, and size) that are compatible with the task to be performed.

4.3 HCI Design Process:



The steps in the HCI design process can include the following steps:

1. Analyzing the users and determining their needs.
2. Drafting an initial design based on the users' needs analysis.
3. Testing the initial design with users in an HCI testing laboratory or in a real user work environment.
4. Developing a prototype system based on the initial design and users' feedback.
5. Testing the prototype system with users in an HCI testing laboratory or real user work environment.
6. Designing and refining each specific interface and screen.
7. Testing the interface with users in an HCI testing laboratory or a real user work environment.
8. Refining the interface based on users' feedback.
9. Implementing the interface.

5. HCI MODEL:

Foley (1980) provides a comprehensive HCI model that includes the following four levels:

The first stage is the **conceptual** level understanding of the user's mental model of the HCI task. Users may have different mental images of the HCI task. For example, users have very different mental pictures of the Web. If you ask people to draw a picture of the Web, these pictures might include the following very different representations: hierarchy, telecom, library system, network, and 3-D web. Another example is that some users equate using a word processor with a typewriter interaction; a computer keyboard is similar to a typewriter keyboard.

The **semantic** level understanding includes the meaning of the user's input to the computer and the computer's output to the user. The input-output feedback loop between user and system only works effectively if the computer understands the user's input and the user understands the system's output. This can be a problem if the system's output is culturally based. For example, Americans understand the "trash" icon, but the British use the word garbage and may not understand the "trash" icon.

In the **syntactic** level, there is an understanding of how the words used are assembled into meaningful sentences that instruct the computer to perform a certain task. HCI works well when users can express their needs in meaningful sentences to the computer. For example, users often have problems expressing their information need to a Web search engine.

The fourth level, the **lexical** level, includes understanding user's mechanisms when structuring their interaction with the computer. A user's interaction with a computer is structured by the person who developed the interface. If the interface does not allow the user to structure their interaction in a user friendly way, the system interaction may not be satisfactory. For example, when looking for information, people often ask questions of other people. Many Web search engines do not allow the user to ask the computer a question in natural human language or conversation style. A classic site that does allow questions is the Ask Jeeves site.

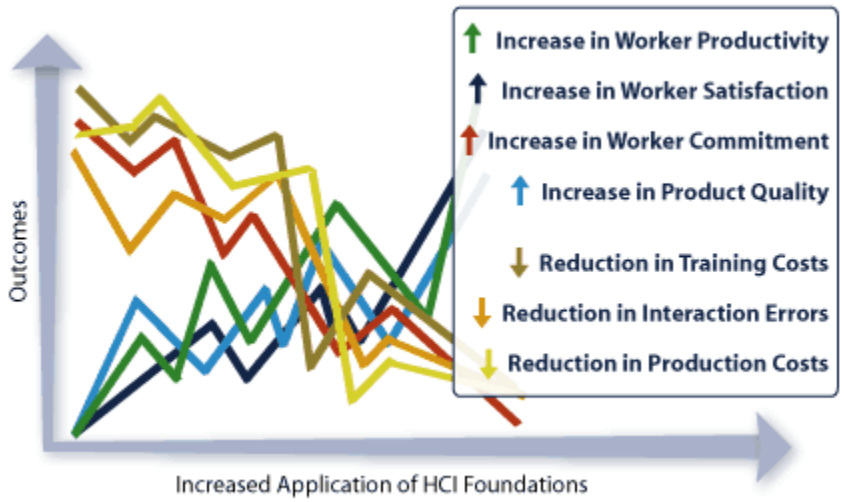
1. Forming the goal of the HCI interaction
2. Forming the intention of the HCI interaction
3. Specifying the HCI action to be performed
4. Executing an action with the computer
5. Perceiving the systems state through feedback
6. Interpreting the systems state through feedback
7. Evaluating the systems output

Norman (1988) provides the following goal-oriented staged model of user's interaction with a computer:

1. Forming the goal of the HCI interaction: User's interact with a computer to solve a problem or achieve a goal. For example, a user's goal may be to find information about motor boats by using a Web search engine.
2. Forming the intention of the HCI interaction: Having established a goal for their interaction with a computer, users must form an intention to use the computer.
3. Specifying the HCI action to be performed: An interface must clearly specify the actions users need to perform. For example, if the user does not clearly understand the correct commands or instructions to conduct an interaction with a Web search engine, their HCI interaction may fail.
4. Executing an action with the computer: A user's HCI interaction must be error free and achieve the correct action. For example, the interface must provide effective help systems.
5. Perceiving the systems state through feedback: The computer output must be in a form that the user is able to see the feedback. System responses must be visible and readable by the user. The size of text and images must be large enough to read.
6. Interpreting the systems state through feedback: The computer output must be in a form that the user is able to understand the feedback. System responses must be comprehensible and understandable by the user. Many computer responses to users input are incomprehensible and are often ignored by users.
7. Evaluating the systems output: Users must be able to evaluate the systems output correctly and effectively. For example, most Web search engines display the results of a user's query as a list of Web sites. Frequently, users do not understand the structure of this Web site list, and how it is ranked and determined by the system.

5.1 Good HCI Work and Design

Solid HCI work serves as the foundation to obtaining the following results. Good human computer interaction work and design is important for obtaining these measurable outcomes:



- Increasing worker productivity
- Increasing worker satisfaction and commitment
- Reducing training costs
- Reducing errors during interface interaction
- Reducing production costs

5.1.1.Increase in Worker Productivity, Satisfaction, and Commitment

Good human computer interaction work and design is important for increasing worker productivity. If workers have problems using computer interfaces, due to poor design, their work effectiveness can be reduced. Effectively designed interfaces that offer customization for users can increase user's work satisfaction. For example, a military fighter plane must have highly effective HCI interfaces to allow pilots to make quick and effective decisions and actions.

Good human computer interaction work and design is important for increasing worker satisfaction. Improved interfaces design can lead to increased worker satisfaction and allow users to achieve their work goals.

Good human computer interaction work and design is important for increasing job commitment by reducing worker turnover. Poor quality interfaces can lead to stress and strain on users both mentally and physically. Users may experience sore muscles or eye strain due to poor HCI interfaces and computer design. Workers may leave their jobs if they are dissatisfied with their HCI experience.

5.1.2.Reduction in Training Costs, Errors, and Production Costs

Good human computer interaction work and design is important for reducing training costs. Poor HCI interfaces may require extensive and expensive user training. Good interfaces with effective online or manual training documents and user system guides can help users to master their system interaction quickly. For example, commercial pilots learn to fly airplanes using computer-based cockpit simulators.

Good human computer interaction work and design is important for reducing errors during interface interaction. Effective interfaces and user training can reduce errors in system use. For example, an effective retail interface can reduce the time taken to complete a sale. Also, most of the problems that led to the Pennsylvania Three Mile Island nuclear power plant disaster were due to poorly designed computer systems.

Good human computer interaction work and design is important for reducing production costs. Effective interfaces allow workers to produce better quality products and services. For example, an effective Website can assist users to view products and services offered by companies, including better customer services.

6. USABILITY:

An important part of the user centered design process is the incorporation of usability testing during both the design and evaluation stage of the systems or interface development. Usability refers to how easy an information technology is to use. Useful information technologies must be functional, useful, and learnable by humans.

Usability testing is important for:

1. Demonstrating the strengths and weaknesses of a design process and product. Usability testing includes collecting data that can be used to improve and redesign the interface.
2. Evaluating the overall design and specific system features. For example, HCI workers may test if users prefer a command line or menu interface.
3. Assessing the functionality of the system for a particular organization or set of users.
4. Validating the effectiveness and efficiency of the system, including potential productivity gains.
5. Providing the system designers with feedback on user satisfaction.
6. Identifying errors or mistakes in the systems design.

7. CONCLUSION

In conclusion, in the process of describing the current state of HCI and things to come this website has shown that HCI has come a long way from the arcane interfaces of Unix and Vi up through Virtual Reality, which promises to allow users to interact with computers in much the same way that they interact with the physical world.

In this site a number of goals and criteria for evaluating interfaces were presented. These are not hard and fast rules. HCI is still a subjective and changing field. The degree to which a goal or criteria is applicable changes from

person to person and program to program. However, the goals presented in this paper were meant to be broadly applicable so that they would encompass most interfaces in existence today. Also, HCI is definitely a changing field and it will continue to change as computers and their uses change. It is an ever evolving field but it is always true to its one underlying aim - to make the computer more friendly and easy to use for the user.

8. REFERENCES

[1]. http://www.wikipedia.org

[2]. http://www.studymode.com/

[3]. books.google.co.in/

[4]. http://www.hciprojectcit06.wordpress.com/

[5]. http://www.personal.psu.edu/