

An Overview of Human Computer Interaction and Its Research Trends

Mrs. Priyanka G.Jaiswal

Assistant Professor

Yeshwantrao Chavan College of Engineering, Nagpur.

Abstract: *The intent of this paper is to provide an overview and nimble on the concept and subject of Human-Computer Interaction (HCI). The outline includes the basic definitions and terminology, various applications and survey of existing technologies and recent advances in the field like how to do visualization of data for knowledge discovery, brain computer interface, etc. and what will be the scenario after 20 years from date.*

Keywords: Computer, HCI, Human, Interface

1. Introduction

According to Albert Einstein “**Computers are incredibly fast, accurate, and stupid. Human beings are incredibly slow, inaccurate, and brilliant. Together they are powerful beyond imagination.**” [6] So for getting brilliant and fast result human and computer need to come together. For that it is must to have an interface between user and computer, and that is promising with the HCI. Theoretically HCI is defined as “A discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of the major phenomena surrounding them.”

Make use of computers had always begged the question of interfacing. The methods by which human has been interacting with computers has travelled a long way. The journey still continues and new designs of technologies and systems appear more and more every day and the research in this area has been growing very fast in the last few decades.

The progression in Human-Computer Interaction (HCI) field has not only been in quality of interaction, it has also experienced different branching in its history. Instead of designing regular interfaces, the different research branches have had different importance on the concepts of multimodality rather than uni-modality, intelligent adaptive interfaces rather than command/action based ones, and finally active rather than passive interfaces.

This paper intends to provide an overview on the state of the art of HCI systems and cover most important branches as mentioned above. Then an overview of existing technologies and also recent advances in the field is provided. This is followed up by a description on the different architectures of HCI designs. The final sections pertain to description on some of the applications of HCI and future directions in the field.

2. Overview on HCI

The advances made in last decade in HCI have almost made it impossible to realize which concept is fiction and which is and can be real. The thrust in research and the constant twists in marketing cause the new technology to become available to everyone in no time. However, not all existing technologies are accessible and/or affordable by public.

2.1 HCI Systems Architecture

Most important factor of a HCI design is its configuration. In fact, any given interface is generally defined by the number and diversity of inputs and outputs it provides. Architecture of a HCI system shows what these inputs and outputs are and how they work together. Following sections explain different configurations and designs upon which an interface is based.

2.1.1 Unimodal HCI Systems

As mentioned earlier, an interface mainly relies on number and diversity of its inputs and outputs which are communication channels that enable users to interact with computer via this interface. Each of the different independent single channels is called a modality a system that is based on only one modality is called *unimodal*.

They can be divided into three categories:

1. Visual-Based
2. Audio-Based
3. Sensor-Based

2.1.2 Multimodal HCI Systems

The term multimodal refers to combination of multiple modalities. In MMHCI systems, these modalities mostly refer to the ways that the system responds to the inputs, i.e. communication channels.

Multimodal interfaces can offer a number of advantages over traditional interfaces. For one thing, they can offer a more natural and user-friendly experience. For instance, in a real-estate system called Real Hunter [24], one can point with a finger to a house of interest and speak to make queries about that particular house. Using a pointing gesture to select an object and using speech to make

queries about it illustrates the type of natural experience multimodal interfaces offer to their users. Another key strength of multimodal interfaces is their ability to provide redundancy to accommodate different people and different circumstances. [3]

3. New Trends and Opportunities

For many years, humans have sent commands to "machines" primarily via the keyboard-mouse paradigm — also known as WIMP (windows, icons, menus, point-and-click devices). Here, the term *machine* is used in a very broad sense: in addition to the point-and-click devices that are usually associated with computers,

3.1: We use a keyboard of kinds to dial numbers on a telephone, to interact with a TV, to select a wide range of functions on a car dashboard, and many other activities that employ key-based interaction modalities. In most cases, the machine's output to the user is then based on a display device such as a monitor.

3.2: Several affordable sensors have begun to shake up the way people interact with devices. Touch and multi touch screens have driven the change from cellular phones to smartphones, and gestures are now the main interaction modality to activate functions on personal devices. At the same time, speech recognition technologies and CPUs' increased computational power let users efficiently provide inputs when they can't perform gestures.

3.3: Personal devices are the most evident example of how new forms of HCI can reduce the gap between humans' mental models and technology. One market that has led this deep innovation in HCI is entertainment. With users asking game and device makers for new ways to control characters, game console developers proposed controllers to release players from the constraints of using a keyboard and mouse? The new interface becomes a means for providing tactile feedback as well as acting as a sort of tangible interface (the controller becomes a steering wheel, a gun, or a tennis racket, for instance).

3.4: Sensors such as the Microsoft Kinect are a further step toward the implementation of fully natural interfaces in which the human body becomes the controller. The device lets users provide commands to the machine via gestures and body poses as embedded hardware performs real-time processing of raw data from a depth camera, thus obtaining a schematic of a human skeleton comprising a set of bones and joints. Recognizing the position and orientation of bones lets the hardware identify poses and gestures, which can be mapped to commands for the machine.

3.5: Researchers have also proposed sensors that can track a user's hands. For instance, the Leap Motion can interactively track both hands of a user by identifying the positions of finger tips and the palm center, and later computing finger joints using an inverse kinematics

solver. Some car makers are already proposing a hand-tracking based alternative interaction modality in lieu of traditional touch screens devoted to managing infotainment functions. Similarly, some smart TVs let users control their choices with a set of gestures, thus replacing the traditional remote control.

3.6: Found only in science fiction movies just a few years ago, the above-mentioned scenarios are now the present reality of HCI. On the other hand, new and more intriguing scenarios appear to be imminent, as brain interfaces seem poised to invert the relationship between humans and machines, for instance. This new interaction paradigm's success will rely on future technological advances, which aim to transform interface devices into wearable and embeddable objects. Interfaces based on augmented reality (AR) technologies are clear examples of this transformation. Many applications for tourism, entertainment, maintenance, shopping, and social networks are already available for personal devices, but new wearable sensors might soon change our habits. Google Glass will be (massively) marketed in the near future, and new application fields are proposed daily. Human-machine interaction and human-machine "integration" are doomed to become very similar concepts, and indeed, Google Glass-like solutions could soon be replaced by contact lenses that implement natural eyewear-based interfaces. [1]

3.7: Persons with disabilities are often unable to use computers. This is because they are either unable to find a suitable means of interaction or they simply cannot afford commercial solutions. In study also found that available solutions do not promote the individual's sense of independence, It allows persons, who may have disabilities ranging from not being able to use their hands to severe cases where the person is only able to move their head, to navigate and

Manipulate the graphical user interface using head movements and speech. This System is used for user with Motor impairments people who cannot use their hands to operate a computer mouse also they are unable to use the shortcuts of keyboard to operate the system because of disability, but wish to operate a computer. [3]

New forms of HCI will significantly change our lives. New interaction paradigms offer the chance to improve quality of life for people who can't take advantage of current interfaces — due to physical disabilities, for example. On the other hand, new issues will arise — particularly related to privacy, security, and ethics — thus potentially slowing the diffusion of new hardware and software products based on wearable (and "invisible") devices. Although some researchers have already investigated relationships between interface design and legal and privacy issues, national legislations are heterogeneous and not yet ready to cope with present and future advances in HCI.

4. Conclusion

The subject of Human Computer Interaction is very rich both in terms of the disciplines it draws from as well as opportunities for research. Discussed here was just a small subset of the topics contained within HCI. The study of user interface provides a double-sided approach to understanding how humans and machines interact. The main purpose of this paper is to make people aware about the concept.

References

- [1] "Human-Computer Interaction: Present and Future Trends" <http://www.computer.org/web/computingnow/archive/september2014#sthash.DcDEERxU.dpuf>
- [2] Guest Editors' Introduction • Paolo Montuschi, Andrea Sanna, Fabrizio Lamberti, and Gianluca Paravati • September 2014
- [3] "An Overview on Designing of Hands Free Mouse Pointer for Motor Impairment People Using Motion Tracking and Speech Recognition" Priyanka G. Jaiswal, Prof. Pragati Patil, Prof. Girish Agrawal AGPCE, Nagpur (M.H.), INDIA
- [4] "Human-Computer Interaction: "Overview on State of the Art" Fakhreddine Karray, Milad Alemzadeh, Jamil Abou Saleh and Mo Nours Arab Pattern Analysis and Machine Intelligence Lab., Department of Electrical and Computer Engineering University of Waterloo, Waterloo, Canada, international journal on smart sensing and intelligent systems, vol. 1, no. 1, march 2008
- [5] D. Te'eni, J. Carey and P. Zhang, Human Computer Interaction: Developing Effective Organizational Information Systems, John Wiley & Sons, Hoboken (2007).
- [6] The Essential Guide to User Interface Design, Second Edition an Introduction to GUI Design. Principles and Techniques Wilbert O. Galitz
- [7] Being Human: Human-Computer Interaction in the year 2020 Editors: Richard Harper, Tom Rodden, Yvonne Rogers and Abigail Sellen ISBN: 978-0-9554761-1-2
- [8] IJCSMS International Journal of Computer Science and Management Studies, Vol. 11, Issue 02, Aug 2011, "Human Computer Interaction: An intellectual approach" Kuntal Saroha¹, Sheela Sharma², Gurpreet Bhatia³