Human-Computer Interaction (HCI)

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Abstract **- In this research, literature in human-computer interaction is reviewed and the technology aspect of human computer interaction related with digital devices is also analyzed. According to all these concerns, recommendations to design good human-computer digital devices are analyzed and proposed. Due to improvements in both hardware and software, digital devices have unveiled continuous advances in efficiency and processing capacity. However, many of these systems are also becoming larger and increasingly more complex. Although such complexity usually poses no difficulties for many users, it often creates barriers for users while using digital devices. Usually, in designing those digital devices, the human-computer interaction is left behind without consideration. To achieve dependable, usable, and well-engineered interactive digital devices requires applied human computer interaction research and awareness of its issues.**

Keywords - Digital Devices, Natural Language Processing, Non-cognitive properties, Human Computer Interaction.

1. INTRODUCTION

Study of interaction between human and computer to design human centred skills , so that there are principles and methods to create excellent interfaces with any technology.

Today, computers have a significant role in education and healthcare. The digital devices such as notebook, tablet pcs and handheld portable devices such as smartphones have become almost usual equipment. The usage of electronic devices in the field of

healthcare and education environment is significant, because it offers attractive, more realistic and interesting facility. At the same time usage of digital devices in the classroom is intended to enhance the learning environment for all students. It was also evident that the use of digital devices in classroom was effective in enhancing motivation, the ability to apply course based understanding, and whole academic achievement amongst students.

This thesis deals with interaction design for a class of upcoming computer technologies for human use characterized by being different from traditional desktop computers in their physical appearance and the contexts in which they are used. Such technologies include for example wearable computers, context-aware computers, immersive virtual spaces and per-vasive computerized environments and are typically referred to as emerging technologies. Emerging technologies often imply interaction dissimilar from how computers are usually operated. One example of this is location-aware car navigation systems. Such systems are operated by moving through physical space, receiving spoken instructions and pressing a few dedi-cated buttons within close proximity of the steering wheel and do not apply WIMP-based interaction as we know it from traditional desktop computers. Consequently, such systems challenge the scope of established human-computer interaction styles and concepts and applicability of established methods and tools for their design.

The research presented in this thesis contributes to the production of knowledge about viable design solutions and processes for human-computer interaction.

In the following sections, the notion of human-computer interaction design is presented in order to describe the focus of the thesis, and a distinction between interaction design and designing interaction is introduced and discussed.

2. LITERATURE REVIEWS

Human-computer interaction can be viewed as two powerful information processors (human and computer) attempting to communicate with each other via a narrow-bandwidth, highly constrained interface. Human-Computer Interaction (HCI) is defined by (ACM SIGCHI, 1996) as "a discipline concerned with the design, evaluation, and implementation of computing systems for human use and with the study of major phenomena surrounding them. As by the definition HCI knows as intersection of different disciplines such as computer science, behavioral science and several others. As the result there is real confusion in what HCI is, a science, a design science or an engineering

discipline. Newell & Card (1985) defined HCI as a science; HCI is tempered by approximation, providing engineering-style theories and tools for designers. Carroll & Campbell (1989) defined HCI as a design science, developing a craft-based approach and new research methods to evaluate existing systems in their intended and tasks context, using the results to inform designers for the next generation of systems. The design and strategy of humans and computers intermingling to accomplish work effectively, exposed as an engineering discipline (Long & Dowell, 1989).

Preece(1994) defined as, Human-computer interaction (HCI) is "the discipline of designing, evaluating and implementing interactive computer systems for human use, as well the study of major phenomena surrounding this discipline" (Preece, 1994). As the whole human–computer interaction studies related with both human and machine in combination, it draws from supporting knowledge on both the machine and the human side. Dix(1998) stated that HCI involves the design implementation and evaluation of interactive systems in the context of the users' task and work. Human Computer Interaction basically concerned with the interfaces between man and machine. HCI differs from human factors (or ergonomics) in some ways. HCI mainly focus more on user's perspective, working specifically with computers. HCI also focuses on the implementation mechanisms in software and hardware production to support effective human computer interaction.

While designing devices, the cognitive processes whereby users interact with computers should be considered as main issue because commonly users' attributes do not match to the capabilities of such devices. At the same time such devices may have non-cognitive effects on the user such as users' reaction to virtual worlds. But in most cases humans strongly recommend the usual cognitive effects. Reeves & Nass (1996) proved as humans have a robust tendency to react to computers in similar ways as they do to other individuals. By considering the communication between humans, interpreting the blend of audio and visual signals holds vital role in understanding communication.

The primary goal of Human Computer Interaction is to improve the interactions between users and computers. It makes computers more operational and receptive to the user's wants. Human computer interaction develops or improves certain goals in designing devices. Five important goals are:

Safety
Utility
Effectiveness
Efficiency
Usability

During 1990's the term usability has become popular in all activities in human computer interaction. Diaper stated that the study of HCI became the study of Usability.

3.1 Models

A model describes the way of interaction between user and computer.

3.2 Norman's model of interaction

Norman concentrates on user's view. With the help of psychology, Norman describes the user's cognitive process as the interaction with technology in daily life. Norman's model is divided into two phases: execution and evaluation. Each phase is divided into several steps. As the whole it contains seven distinct steps.

The identified steps are:
Forming the goal
Forming the intention
Specifying an action
Executing the action
Perceiving the state of the world
Interpreting the state of the world
Evaluating the outcome

3.3 The Interaction Model

Abowd and Beale defined this framework of interaction as translation between languages. They state both a common interaction framework and a translation within the framework. Abowd and Beale framework concentrate on four components and each has its own unique language. Those are;

User
Input
System
Output

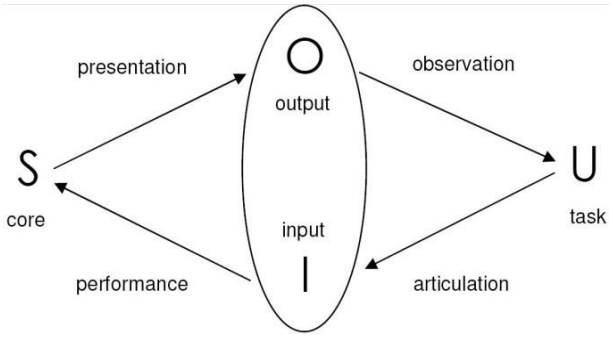

Figure 1: Interaction Model: Abowd and Beale Framework

3.4 Structure of HCI

HCI, as the name suggests, comprises three major parts within the framework: the user, the computer, and the interaction, indicates the ways they work together to achieve goals. Figure 2 shows three main components of human computer interaction.

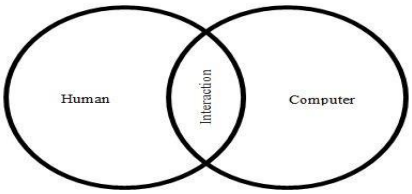

Figure 2: Three components of HCI

3.5 The user

The user analysis is a critical part of user-centered systems design. The public or the user of HCI could be considered as the user of systems. They may vary based on the purposes and task they have in the system. The distinct characterization of users depends on the above task and purpose with their experience on it. Danino (2001) stated that the user of HCI is whoever uses technology to try to get the job done.

3.6 The computer

Danino (2001) stated that the computer in HCI denotes any technology that comprises from desktop computers to generalized computer systems; even an embedded system or an information processing engine can be viewed as "computer". A computer is a device used for general purpose and it carries out several arithmetic and logical operations with the human help. The way of interaction with computers is not limited with the traditional shape of the computer because of the incredible technological development. But Human computer Interaction is focused on interfaces involved in man and machine. Each and every device consists of some kind of user interface for its usage. Normally it involves huge amount of interaction.

3.7 The interaction

The major component in Human Computer Interaction is interaction between man and machine. Normally humans interact with other humans through speech. At the same time they support their expression with some body gestures, emotions and certain expressions. The non-cognitive properties of a computer system on the user must be looked carefully, because humans always have a solid tendency to respond on a computer in the same ways as they react to the practical world (Reeves & Nass, 1996).

4. RESEARCH ON INTERACTION BETWEEN HUMANS & DEVICES

4.1 Research on devices support the learning process

Input efficiency takes major role in learning supportive devices. In most cases learning supportive devices use to gather or acquire lecture notes in real time. Interaction styles mention the dissimilar ways of communication in between humans and computers. Different systems use different interactions styles. But some common interaction styles are there, those are individually evaluated.

4.2 Command line languages

This is one popular mode of interaction between humans and computers. Here the computer accepts some typed meaningful commands. Usually user can type one command at a time, thus it is very slow in taking data in. Particular application process or execute the subsequent inputs given by user and give some feedback.

It has some considerable advantages, but the interaction becomes a dialogue only, particularly the human is the lively side and face more workload than computer. Two important pros and cons of command line languages related with academic supportive devices are listed in Table 1

Table 1: Pros and Cons of Command line languages

Pros	cons
Cheap	Low Visibility
Flexible	Error handling

Because of low visibility of command line languages are hard to use in real time environments. Error correction mechanism is very important because of its real time usage. But this facility is very much lack in such command line languages.

4.3 Menus

As the name indicates the menu interface exactly borrows its name from the list of dishes or food items that can be chose in a restaurant or food corner. In same way, a menu interface offers the user with a pre-defined static list of selections in an onscreen fashion. A collection of choices displayed on the screen where the selection and execution

of one or more of the selections results in a transformation in the state of the interface (Preece, 1994). There are four brave categories of menus:

- Pull-down menus
- Pop-up menus
- Hierarchical menus
- Contextual menus

Two important pros and one cons of menus in Table 2.

Table 2: Pros and Cons of Menus

Pros	Cons
No need to recall	Limited
Logical Group	limited

4.5 Graphical and direct manipulation

The direct manipulations involve in representing the data or information through graphical format. Table 3 indicates the pros and cons of direct manipulation with devices.

Table 3: Pros and Cons of direct manipulation

Pros	Cons
User sensitive	Limited
Flexible	Limited

4.6 Form fill-in, Question and answer and function keys

By the nature form fill-in, question and answer and function keys are not suitable in academic supportive devices. These three styles of interaction are fully concentrated on a pre-defined flow. But currently requires a dynamic input flow, it acquires input data in a real time environment.

4.7 Natural language

Natural language processing (NLP) is concerned with human languages such as local languages. It is a field of computer science correlated in the area of Human Computer Interaction.

The usage of natural language processing is very much important with comparing other interaction styles. Here we considered the natural language interfaces, a type of interface that allows users to use their own language to input data. Interaction becomes easier in this type of interface.

Supportive devices are given:

5.1 Parallel inputs

Devices accept more than one input at a single point of time; each input has been filtered by filters. Finally gathered different input data combine by the combiner, where noises get removed. Before storing the data device prompt with feedback to user. Figure 3 indicates the stages in gathering parallel inputs.

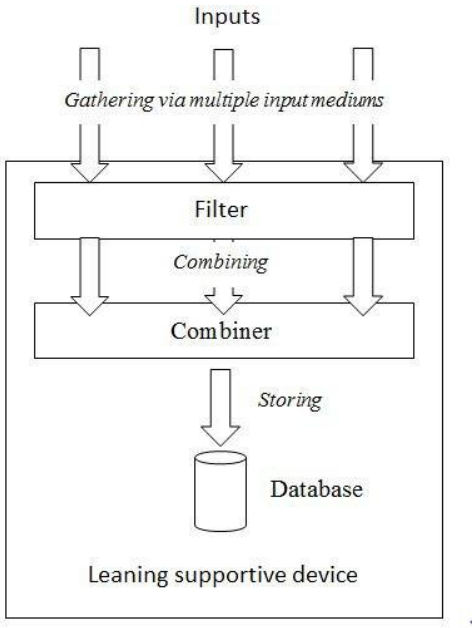

Figure 3: Stages: Accepting parallel inputs

5.2 Voice recording

Voice is natural way of interaction in environments. But continuous voice output is tough to gather or achieve. Even though it is easy to record the voice through interfaces in devices with minimum error rate without interruption, much of the argument under voice as input.

Research in finding the way to gather voice input and integrate it into multimode interface is particularly significant. In this case use microphone is simple to get voice input, may have to face problems when having noisy environment. In such cases it is important to integrate parallel input mechanism to avoid loss of data or lecture inputs.

5.3 Hand writing recognition

It is also a natural way of interaction, even better than voice input. Users can avoid the unwanted conversation here by using handwriting recognition interfaces.

The interfaces with hand writing recognition can be cooperative in reduce the use of other input devices such as mouse and keyboard, and hence reduces the time in inputting. It is useful in solving or writing mathematical or diagrammatical inputs.

6. REVIEW

We found some significant review factors in Human-computer Interaction(HCI). Shniderman (1986) stated that the researchers have found that re-design of the human computer interface can create a considerable difference in learning time, performance, speed, error rates and user satisfaction.

7. CONCLUSIONS

In the above research, human computer interaction literature is reviewed as well as technological matters like interaction styles are studied and pros and cons are dogged. And we searched for better interaction styles among the existing ones. At the same time we found dome best "fit" in between a human and a computer in terms of interaction.

While designing moral, effective and user-friendly interfaces, several disputes have to be considered. This research suggests a theoretical support in the area of human computer interfacing. In this paper we have deliberated the promising use of Human Computer Interaction to attain top levels of interaction between user and devices.

We conclude that to design a worthy human computer interaction, we have to appropriately elect the suitable style of interaction, kind of interface to adequate with the group of users it is intended whereas the human issues must be taken into account. Therefore we recommend some important modes of interaction such as parallel input, voice recognition, interoperability among devices and handwriting recognition. We recommend related human-computer interaction design..

Clearly, we now analyzed all existing techniques in human-computer interaction, in order to increase the efficiency of devices. However, the implementation of suggested interaction styles and models offer a sound basis for the future research.

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