

The Fundamentals of Human-Computer Interaction



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INTRODUCTION

As modern technologies continue to develop, the ability of users to interface with new computer systems becomes a paramount concern (Information Resources Management Association, 2016). Human-computer interaction (HCI) is a field of research that develops the advanced activities of user-computer interaction (Anishchenko, Osinov, & Shaposhnikov, 2011). HCI has been the focus of attention for researchers in the past decade, with considerable work being done in the various modalities for communicating with the computer (Reddy & Basir, 2010). HCI studies play an important role in the design, implementation, and evaluation of a new generation of graphical user interfaces designed to support consumer behaviors and information needs (Servidio, Davies, & Hapeshi, 2016).

Humans are limited in their capacity to execute the information. This perspective has the important implications for the interaction design. Information is received and responses given via a number of input and output channels, such as visual channel, auditory channel, haptic channel, and movement. A primary goal of virtual environments is to support the efficient, powerful, and flexible HCI (Devyatkov & Alfimtsev, 2013). A computer system comprises various elements, each of which affects the user of the system. Input devices for interactive use, allowing text entry, drawing, and selection from the screen. Output display devices for interactive use: different types of screen mostly using some form of bitmap display; large displays and situated displays for shared and public use; and digital paper may be usable in the near future.

The interaction takes place within a social and organizational context that affects both user and system. Iterative design practices work to incorporate crucial customer feedback early in the design process to inform critical decisions which affect usability. Interaction models help practitioners and researchers understand what is going on in the interaction between user and system. Many interfaces, relying on body gestures (Liu & Jia, 2004), speech (Green & Eklundh, 2003), and brain computing (Mason & Birch, 2003), have been proposed or developed which assist humans to interact with robots in a more intelligent and natural activity. Various interaction techniques have been developed for interactive 3D environments (Jankowski & Hachet, 2015).

This article aims to bridge the gap in the literature on the thorough literature consolidation of HCI. The extensive literature of HCI provides a contribution to practitioners and researchers by explaining the fundamentals of HCI in order to maximize the impact of HCI in global operations.

BACKGROUND

HCI emerged as a distinct research discipline in the late 1970s and early 1980s when monitors and workstations became available and opened up the use of computers to non-engineers (Grudin, 1990). In the 1990s, network technology and mobile devices broadened the scope of research beyond the individual user and personal computers (Hollender, Hofmann, Deneke, & Schmitz, 2010). HCI should be designed to be effective, efficient, engaging, error tolerant, and easy to learn (Fall-

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man, 2010). With the development of computer vision technology, researchers have studied a lot of HCI methods to replace the keyboard and mouse (Juan, 2012).

Major HCI research areas comprise theories and models of human behavior when interacting with information technology (IT), general or more specific guidelines or heuristics for the design and evaluation of IT, methods for the user-centered development of IT, and the development of new interaction paradigms (Preece, Sharp, & Rogers, 2002). Interaction models address the translations between what the user wants and what the system does. Ergonomics looks at the physical characteristics of the interaction and how these influence its effectiveness. The dialog between user and system is influenced by the style of the interface. Examples of effective strategies for building interactive systems provide paradigms for designing usable interactive systems. The evolution of these usability paradigms also provides a good perspective on the history of interactive computing.

Different HCI techniques and technologies with different design criteria have been developed for several decades (Rantanen, Niemenlehto, Verho, & Lekkala, 2010). Interaction design is about creating interventions in often complex situations using technology of many kinds including PC software, the web, and physical devices. Usability is key to the success of any interactive system—from commercial software to business-to-business (B2B) websites to the handheld devices (Rosson & Carroll, 2001). Promoting consistency in user interface and application design remains a prominent practical issue (Nielsen, 1989). Software engineering provides a means of understanding the structure of the design process, and that process can be assessed for its effectiveness in interactive system design. Designing for maximum usability is the goal of interactive systems design. Evaluation tests the usability, functionality and acceptability of an interactive system.

THEORY AND APPLICATIONS OF HUMAN-COMPUTER INTERACTION

This section emphasizes the overview of HCI; cognitive models, socio-organizational issues, and stakeholder requirements; HCI and hand gesture recognition; and the multifaceted applications of HCI.

Overview of Human-Computer Interaction

With the advancement of technologies, a computer system has become a very powerful machine which has been designed to make the human beings' tasks easier (Sharma & Verma, 2015). The power of computers begins to be exploited in subjective areas of human study like those related to human psychology in order to make the interaction between humans and computers more natural (Choubey & Singh, 2012). To achieve the effective HCI, the computer should be able to naturally interact with the user, similar to the way that HCI takes place (Sebe, Cohen, Cozman, Gevers, & Huang, 2005).

Defining what, how, when, and why to build computer resources with accessibility features is one of the main concerns of the HCI area (Peres, Boscarioli, Bidarra, & Fantinato, 2012). HCI pervasively exists in the individuals' daily lives (Yeo, Lee, & Lim, 2015). From an applied perspective, technological advances have changed the way that humans interact with their computers (Posard, 2014). The application of HCI principles are frequently successful in increasing user satisfaction and engagement with an interface (Wohl, Parush, Kim, & Warren, 2014). The correct functioning of interactive computer systems depends on both the faultless operation of the device and correct human actions (Curzon, Ruksenas, & Blandford, 2007).

More natural and comfortable HCI methods are the goal of several research efforts (Tang, Chen, Zheng, Han, & Li, 2015). Traditional methods

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