

Chapter 3

Role-Based Human-Computer Interactions

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ABSTRACT

With increased understanding of cognitive informatics and the advance of computer technologies, it is becoming clear that human-computer interaction (HCI) is an interaction between two kinds of intelligences, i.e., natural intelligence and artificial intelligence. This paper attempts to clarify interaction-related terminologies through step-by-step definitions, and discusses the nature of HCI, arguing that shared models are the most important aspect of HCI. This paper also proposes that a role-based interaction can be taken as an appropriate shared model for HCI, i.e., Role-Based HCI.

1. INTRODUCTION

Interaction is an important element of social activity and is a key aspect of cognitive informatics. Good interaction skills may assist people who are striving for success in their careers. Conversely, individuals who lack strong interaction skills may suffer adverse effects throughout their lives.

HCI has been a topic of research for nearly half a century (Myers, 1988), and has been studied from various vantage points. For example, a large

body of evolutionary interaction research currently exists, and the research includes empirical studies, sensors, input tools, and user models as pertaining to HCI. Notably, the major interaction style currently used is still WIMP (Windows, Icons, Menus, and Pointers). On the whole, however, the advances in these research areas are still disappointing. The growing number of research topics has given rise to special domain characteristics. For example, Human-Robot Interaction (HRI) has been proposed to concentrate on special interaction problems related with robotics (Yanco et al., 2004).

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There is a definitive lack of research on the fundamental issues associated with interactions, which is a clear shortcoming in HCI research. Many investigators have built concrete tools without clarifying the fundamental concepts, theorems, and principles underlying them. This methodology may produce many evolutionary products and designs, but makes revolutionary improvements very difficult to obtain.

Cognitive informatics examines the fundamental principles of the natural and man-made world as relating to the mind or intelligence. This research clearly affects the development of computer technologies as computers have been designed from their inception to simulate human behaviour (Wang, 2007a, 2007b, 2009a). Thus, investigating the principles, models, and processes of interactions is one of the most important tasks for cognitive informatics.

This paper uses step-by-step definitions to clarify the fundamental issues underlying interactions from the viewpoint of cognitive informatics, and reveals important fundamental concepts for interactions. It proposes different categories of interaction, and argues that a successful interaction is based primarily on shared models. Finally, it argues that roles are a promising shared model for HCI.

The structure of this paper is as follows: Section 2 presents definitions related to intelligence; Section 3 classifies different types of interactions; Section 4 discusses the differences between human-human interactions (HHI) and HCI; Section 5 discusses shared models of interactions; Section 6 presents role-based HCI; Section 7 presents a case study that used role-based HCI methodology; Section 8 reviews related work; and Section 9 presents conclusions and directions for future work.

2. NATURAL INTELLIGENCE AND ARTIFICIAL INTELLIGENCE

Although the term “intelligence” has been in use for a long time, a widely-accepted definition for the term does not seem to exist. Many researchers agree that “intelligence” or “natural intelligence” are terms used to describe a property of a person’s mind that encompasses many related abilities, such as the capacities to reason, plan, solve problems, think abstractly, comprehend ideas, use languages, and learn.

According to Dictionary.com (<http://dictionary.reference.com/>), intelligence is defined as:

1. A capacity for learning, reasoning, understanding, and similar forms of mental activity; aptitude in grasping truths, relationships, facts, meanings, etc.
2. A manifestation of a high mental capacity.
3. The faculty of understanding.
4. Knowledge of an event, circumstance, etc., received or imparted; news; information.
5. The gathering or distribution of information, esp. secret information.
6. An interchange of information.

Furthermore, Artificial Intelligence (AI) is defined as the intelligence of machines and it is a branch of computer science that aims to create intelligence (Boden, 1987; McCarthy, 2010). Russell and Norvig (2003) define AI as “the study and design of intelligent agents” where an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success. Intelligence may be defined in a gradual way.

Intelligence may be understood by defining the concepts step by step.

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