Chapter I

Cognitively Informed Systems: Justifications and Foundations

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Abstract

Cognitively informed systems as introduced by Alkhalifa (2005b) is a perspective that encourages system designers to consider the findings of cognitive science as informative to the design of their systems. This relies on an underlying assumption that the presentation, interaction abilities, as well as the system structure, are likely to achieve more efficient communication if the design is aligned with the expectations of the human cognitive machine. In other words, this perspective deals with issues such as how to best present materials for the perceptual system to isolate the required differences and focus on the correct points in the image, how to offer sufficient interaction to enhance learning, or how to elicit different levels of cognitive engagement with the system. This chapter offers a survey of the main areas of the field and examples are given of how these areas can inform particular aspects of future system design. A case study is also presented as support to this perspective. The main conclusion that
can be drawn is that this new perspective is not only practical but also worthwhile.

**Background**

Paul Thagard (2004) describes cognitive science as the interdisciplinary study of mind and intelligence. He indicates that it embraces philosophy, psychology, artificial intelligence, neuroscience, linguistics, and anthropology. The first fruits of this science emerged in the mid-1950s when researchers in several different fields, including George Miller, John McCarthy, Marvin Minsky, and Allen Newell, started to place the foundations of theories of mind. They started by founding the field of artificial intelligence and in their endeavor to do so, started to study the workings of the cognitive system, with the attempt of learning how it works and modeling that onto a computer system.

The main foundation of the science is that thinking can be understood in terms of representational structures of the knowledge in the mind, and that computational procedures may describe all the processing required on those structures that is necessary to make deductions (Thagard, 2004).

There are two standard computational approaches that are utilized in modeling any system in cognitive science. The first is described as symbolism and deals with symbolic processing where each concept is given a symbol to represent it and rules are utilized to make deductions based on the values of these symbols. The second is known as connectionism, where neural networks are used to represent the structure of the system where each neuron acts as a unit that interacts with its inputs to produce its outputs (W illaford, 2004). According to Andy Clark (1993), cognitive science, “sets out to explain the mechanisms implicated in events which are recognizably psychological in nature, such as reasoning, planning, and object recognition.”

Consequently, a conclusion that one may arrive at is that this science is rooted in the philosophy of mind and branched out as a science attempting to concentrate and analyze the workings of the human mind and/or brain and to produce computerized models either through symbolic programming or through connectionist modeling. One question that may arise is, Will this theoretical science continue with its current target without any subtrack branching out? In the case of artificial intelligence, expert systems branched out into the world and