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HumanComputer Interaction: A General Behavioral Model for MIS Research

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Introduction

A general model of management information systems (MIS) is consistently represented by the interaction between at least five elements: hardware, software, data, procedures, and people. Furthermore, all definitions of MIS, and indeed Decision Support Systems (DSS), identify the important relationship that exists between humans and the computer systems that support their decisionmaking activity. However, existing models of humancomputer interaction either treat the human component of the system as a "black box" or are limited to the specific nature of the research to which they are attached. This paper offers a comprehensive model of humancomputer interaction, focusing primarily on the human component of the system.

Various limited models of humancomputer interaction or "decisionmaking" activity have been posited. However, research based on a limited model has the capacity to yield inconsistent, nonreplicatable results. Furthermore, with limited models encourage each researcher to develop their own model to more clearly demonstrate the human component as expressed by their research. The consequence of these tailored models is both a limited view of reality as well as a lack of comparability with other research efforts.

The General Human-Interaction Model

A frequent inception point for the development of limited models has been Simon's (1976) intelligencedesignchoice model. The proposed model's "overview" level parallels this development (information acquisitionmanipulationresponse), as shown in Figure 1, yet expounds on these components to promote improved understanding of the individual components, the elements of these components and their interactions. Each of these components (and their elements) was placed in the model based on an examination of other, more limited models (e.g., Bloom et al. 1956, DeSanctis 1984, Hunt et al. 1989, Marzano et al. 1989).

Each component of the general model is subdivided into a <u>trait</u> (style) element as well a <u>state</u> (process) element. These components for information acquisition are learning style and learning process; for information responsedecision style and decision process. Thus, <u>cognitive style</u> is viewed as composed of at least two separable elements (learning style and decision style). The same is also true for <u>cognitive process</u> (learning process and decision process). It is important to note that for both the acquisition and response component that "style" is viewed as a moderator of "process." Moreover, style is moderated by demographic factors and personality.

The manipulation component is composed of cognition, knowledge, mental models, and thinking skills and abilities. Although the elements could be separated into trait (knowledge, mental models, and thinking skills and abilities) and state (cognition) domains, the interaction of these elements is more central to human performance. In this model, cognition is viewed as the "engine" which responds to or drives all other human activity. It may be used to retrieve or acquire new factual or procedural knowledge. It may be used to retrieve or assimilate and accommodate new mental models. It may be used to assemble or amplify new thinking skills and abilities. By this view, knowledge and mental models are viewed as the repositories of information. Furthermore, cognition and thinking skills and abilities are viewed as the "tools" through which this repository is manipulated.

As indicated above, the elements of the human model interact. In some instances, interaction takes place within one component. For example, the act of cognition may involve "turning things over" in one's mind. This would most likely involve an interaction among knowledge, mental models, and thinking skills and abilities. By this mechanism, "new" knowledge or an "improved" mental model could be developed without necessarily involving the acquisition component. However, components of the model frequently interact with each other. For example, developing "new" knowledge may require interacting with one's environmentmeaning an interaction between the manipulation component and the learning process element of the acquisition component of the model. Through the model, it can be demonstrated that the learning process is represented by a demonstration of specific thinking skills and abilities (working in concert with knowledge and mental models). This process is then influenced by an individual's learning style. Similar combinations of elements would be invoked when the response component is activated; however, the specific "mix" of attributes of these elements would be different.

A sample scenario will serve to illustrate the model. An individual interacts with their environment. Within that environment the individual is faced with one or more tasks to which they are required to respond. Elements of individual tasks may be presented to the individual in a number of forms--factors based on the task itself, information which may be available about the task, information which may be augmented by computer support, and environmental factors (including interaction with other humans). In any event, the human user only has a limited set of mechanisms with which to acquire stimuli about a task (sensory receptors--sight, hearing, etc.). Unfortunately, these mechanisms also produce a filter effect on acquired information.

Figure not available. Please contact author.

Human-Computer Interaction General Model

Once a human has received an external stimulus, the actions of the model may be viewed as structured as either a "short loop" (response based on the need to acquire more information) or a "long loop" (response focused on rendering a task solution) activity. (It is further assumed that either loop could be activated without an external stimulus.)

Regardless of the "loop" involved, the human begins to "assemble" a learning process to respond to the stimuli. Unless this is a novel stimulus, it is likely that the human will call on existing mental models and knowledge representing similar or identical stimuli. These choices are likely to be influenced by learning style. If more than a "programmed" response is called for, human cognition will then cause the interaction of knowledge, mental models, and thinking skills and abilities in an attempt to assemble a strategy by which to respond to the stimuli. In this model, thinking skills and abilities are viewed as an independent component of cognition, albeit related to both knowledge and mental models. Knowledge and mental models are viewed more in a repository context, while thinking skills and abilities are view more in a "took kit" context.

At this stage, cognition could iteratively either interact with learning process in the form of "making sense" of the stimuli and extracting information which is useful or interact with decision process to develop a response and decide when the response is sufficiently developed to execute. Decision process is, of course, influenced by decision style (which in turn is influenced by demographics and personality).

Ultimately, the response is judged adequate for execution. This "call for action" is also funneled through the filter of sensory initiators (e.g., manual or verbal activity) and expressed as a decision. Note that the actual mechanism to express a decision could involve direct interactions with other humans, with computer support or both. The consequence of the decision, when interacting with the task and the environment is a decision outcome. Multiple feedback channels are expressed in the model to illustrate that the consequences of a decision have multiple means by which to "inform" the human of resultant action. Thus, it is implied by the model that decision activation is a continuous loop involving human acquisition of information, manipulation of that information, and response to task requirements.

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