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Constructing a Knowledge Based Group Decision Support System with Enhanced Cognitive Analysis

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Abstract: This study explores the possibility of adding Knowledge Based Cognitive Psychology assessment within the Group Decision Making and outlines some of the necessary guidance for designing a Knowledge Based Group Decision Support System (KBGDSS). This framework is using intelligent agent communication and graphical user interface. This prototype, which consists of a data base, knowledge base, model base and agent communication language along with the graphical user interface, will help the group of decision makers to select and solve the problem. The end result is a system that will dynamically adapt to the person using it. The system will be able to identify the nature of the decision-maker currently involved in the process and provide him/her with solutions specifically tailored to that person's unique mental composition.

Key words: Group decision making, knowledge base, emotional quotient, emotional intelligence, knowledge query manipulation language, KBGDSS

INTRODUCTION

Knowledge workers include not only information technology professionals but also management staff such as brokers, urban planners, design engineers, production coordinators, travel agents, marketing executives, etc. Anyone who makes decisions for business, government, military or medical purposes is potential Group Decision Support System (GDSS) users. Computer experts develop most of the DSS. However some of the problems associated with this are that, large number of mathematical and statistical calculations, selection procedures and methodologies, difficulties in determining the most effective solution, varied nature of decision-makers' domains and that Decision-makers are generally not very comfortable using intelligent systems. In this paper we consider the cognitive psychology of individual decision-maker who is all involved in the Group Decision-Making. Users are interacting within the GDSS through an Agent communication Language known as Knowledge Query Manipulation Language (KQML). Decision makers varied nature will be assessed by the Knowledge Base and to get the models from the model base to solve the problem.

GROUP DECISION SUPPORT SYSTEMS

Decision Support Systems provide support for decision-makers who mainly deal with semi-structured and unstructured situations by bringing together human judgment and computerized information. Support is provided for various managerial levels, ranging from top executives to line managers. Group DSS are a specific type of system within DSS, where support is provided to a specific group. GDSS is applicable to all phases of the decision-making process, namely-intelligence, design, choice and implementation. Usually, a DSS utilizes models for analyzing decision-making situations. The modeling capability enables experimenting with different strategies under different configurations. Ideally, a DSS should be adaptive over time and flexible enough to allow addition, deletion, combination, alteration or rearrangement of basic elements.

A model base is a software package that includes financial, statistical, management, scientific and other quantitative models. Modeling languages for building custom models are also included. This is connected with corporate and external storage of models. Any one of the models is to be selected by the decision-makers during their problem solving. This component is often called Model Base Management System (MBMS)[1]. The schematic view of knowledge based Group Decision Support System is shown in Fig. 1.

AN AGENT COMMUNICATION LANGUAGE

Communication among the Decision makers, agents and knowledge base is essential during group decision

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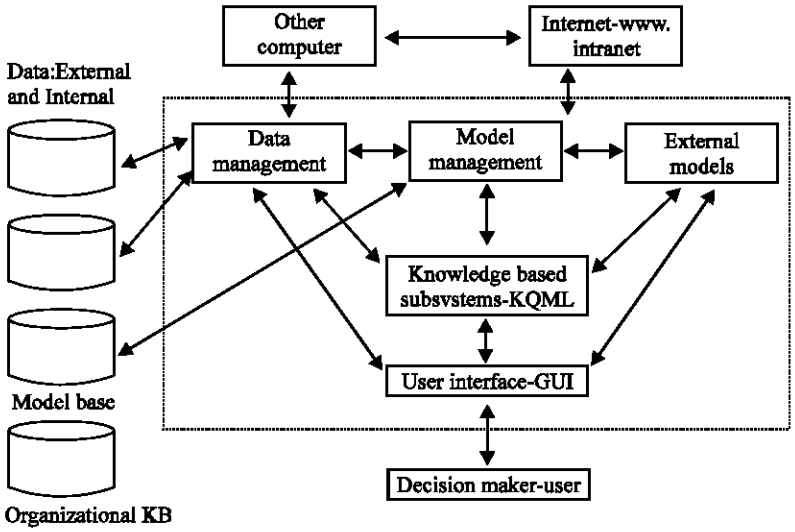

Fig. 1: Schematic view of KBGDSS

making. Agent communication language allows agents to effectively communicate and exchange knowledge with other agents despite difference in hardware, software and operating system, programming language etc during group decision-making. An agent communication language is the medium through which the decision makers exchange their views and ideas during their group decision making irrespective of their present locations and technology associated with them, using world wide web, intranet etc,. It may be a request, a query, or accessing a knowledge base etc., among the members involved in Group Decision Making. KQML is an agent communication language[2,3]. KQML consist of primitives that express attitudes regarding the content of the exchange and allow the decision makers to communicate such attitudes to other agents. Today's technologies like www and corporate intranets have made it possible for people to share their information, ideas etc during decision-making. Web based DSS access is essential during group decision making[4,5].

KQML is a language that is designed to support interaction among intelligent software agents. It was developed by ARPA knowledge share effort consortium. It has been successfully used to implement a variety of information systems using different software architecture. Communication takes places on several levels. The content of message is along a part of the communication. KQML has been designed to work with multiple transport mechanisms and implementation has been done that use TCP/IP, SMTP (email), HTTP and CORBA and objects that carry messages[2,6].

BEHAVIORAL MODELS OF THE DECISION MAKER

The way a person examines a problem and makes a decision can be described from several different viewpoints depending on the assumptions made. The normative model of the decision makers in organization has the following assumptions

- All alternatives and all outcomes are completely known.
- The decision maker seeks to maximize profit or utility and
- The decision maker is infinitely sensitive to difference in utility among outcomes.

The normative model is a prescriptive model of the decision maker; completely rational, having complete information, always choosing the best alternative. It describes how a person should make a decision but, in fact, all criteria of the model are rarely met in a decision situation. Many methods for selecting among alternatives assume complete rationally provide mechanism for identifying the optimal choice.

The administrative model of the decision maker is descriptive. According to Davis[7] the administrative model views the decision as taking place in a complex and partially unknown environment. The decision maker is assumed not to be completely rational but rather to display rationality only within limits imposed by background, perception of alternatives, ability to handle a decision model etc., The Administrative model assumes that the decision maker:

- Does not know all alternatives and all outcomes
- Makes a limited search to discover a few satisfactory alternatives and
- Makes a decision, which satisfies his/her aspiration level.

Problem-Solving strategies for satisfying are based on heuristics or rules of thumb rather than explicit decision rules. This has implications for the design of decision models; they should provide appropriate data and allow decision makers to explore alternatives using their own heuristics.

KNOWLEDGE-BASED COGNITIVE ANALYSIS

Humans display a variety of responses on decision-making; some are related to individual differences such as cognitive style. Others are related to expectations. Some of these responses that occur in decision making under psychological stress[8]. The role of expectations in decision-making can be partially explained by the theory of cognitive dissonance, commitment theory and the theory of anticipatory regret. Knowledge based subsystem consist of emotional quotient base, which is used to calculate or assess the emotional quotient intelligence during the decision-making.

EMOTIONAL INTELLIGENCE

Emotional intelligence[9,10] is defined in terms of emotional empathy, attention to and discrimination of, one's emotions, accurate recognition of one's own and others' moods, mood management on control over emotions, response with adaptive emotions and behaviors in various life situations, especially to stress and tough situations, balancing of honest expression of emotions against courtesy, consideration and respect. In addition to the above, selection of work that is emotionally rewarding to avoid postponement, self-doubt, low achievement and a balance between work and home. During the group decisions making these things are unavoidable.

Emotional intelligence quotient: John D. Mayer and Peter Salovey showed that the ability to direct one's emotions, as well as understanding and influencing other people's emotional responses, went a long way towards effective adaptation to an environment. The Mayer-Salovey model defines emotional intelligence as the capacity to understand emotional information and to reason with emotions. More specifically, they divide emotional intelligence abilities into five areas (Fig. 2).

- The capacity to accurately perceive emotions (Self-awareness)
- The capacity to use emotions to facilitate thinking (Self-motivation)
- The capacity to understand emotional meanings (Empathy)
- The capacity to manage our emotions (Self-regulation)
- The capacity to manage other people's emotion (Social skill)

These five abilities are assessed by ability-based tests. Chilean biologist Humberto Maturana sees emotions as predispositions of the body to certain kinds of actions and not others. He notes for instance that the actions available to an angry person differ from those available to a non-angry person. The trick then becomes how to enter into emotional states that enhance and enrich the range of effective action. He also sees strong two-way connections between emotions and language; in particular, the kind of talk we allegedly constantly use to address ourselves.

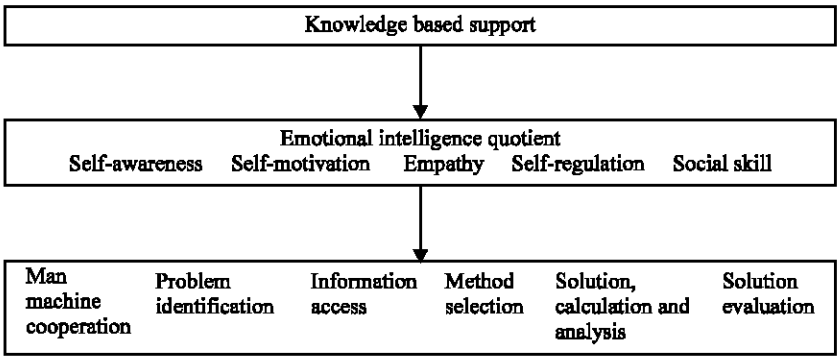

Fig. 2: Functional architectural of knowledge based cognitive psychology analysis

ENABLING EQI IN DSS

The last definition is precisely what will be tapped by our proposed system, in delivering tailor-made solutions. The system will be able to determine the nature of the decision-maker and by factoring that into its knowledge base, be able to deliver a most effective solution. This knowledge-based DSS includes not only a knowledge management component, but also an Emotional Quotient Base, which stores and manages a new class of emerging AI tools[11,12] such as machine learning and case-based reasoning (CBR). These tools can obtain knowledge from prior data, decisions and examples (cases) and contribute to the creation of DSS to support repetitive, complex real-time decision-making. Machine learning refers to computational methods/tools of a computer system to learn from experiences (past solutions), data and observations and consequently alter its behavior, triggered by a modification to the stored knowledge.

The role of the knowledge-based GDSS[13] should be to allow experts to broaden and expand their expertise, not to narrow it down and hence it will incorporate an assemblage of sporadic tests, which will tend to decide the level of EQI associated with the user. Then, not only will the nature of the decision/solution be dependent on the EQI levels, but also the precise wording of the solution, which, as shown, will have a tangible effect on the levels of acceptance to the user. The EQI calculation and reference levels will be in conformance with the Emotional Intelligence Consortium's work on the subject and will rely on their proposed framework of emotional competencies[14].

Economic value of the EQI approach: Ultimately, the success of any approach to DSS depends upon its value to organizations. Additionally, acceptance of emotional intelligence concepts and programs by academics, professionals and organizations will ultimately depend on their demonstrated validity and utility.

The commercial adequacy of this approach may be quite simply evaluated by the following steps:

- Define Performance Criterion
- Develop a Business Case
- Calculate the Economic Value of the problem
- Estimate the difference that can be made by non-machine (e.g., H.R) usage
- Design a Course and Evaluation system for the EQI data gathering
- Monitor the system
- Evaluate Effects of Training

On the whole, the system of EQI data gathering itself is trivial. The complexity lies in the knowledge retrieval and emotional correlation system. This portion of the system must, to reduce redundant heterogeneity, consequently be implemented as a distributed, bi-partite assemblage of the associated DSS components.

CONCLUSIONS

The main aim of the research was to describe the framework of knowledge-based decision support system suitable to the unique characteristics of decision maker enhancing the group decision making. We discussed the emotional quotient of the decision maker plays major role during the development of KBDSS and this system will dynamically adapt, not to a member of the organization, but instead to the person using it. The system will be able to identify the nature of the decision-maker currently involved in the process and provide him/her with solutions specifically tailored to that particular person's unique mental composition.

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