Utilization of Cognitive Mapping Technique in Information System Development

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ABSTRACT: In system development methodology environment there are many methodologies have been developed and adopted. In addition, many experts in system development are attempting to produce new methodologies. Moreover, every methodology has various technique and methods. However, in most information system development scenarios, information requirement definition is the most challenging and essential task in system development life cycle. It is the aim of this paper to explain the concept of Cognitive Mapping Technique which may assist developer team in the stage of information definition requirement. Cognitive mapping or sometimes called mental mapping is a technique used by system developers in developing an information system. It helps them in analyzing the problems and determining stakeholders’ requirements. Also, cognitive mapping is intended to help decision makers in interacting with the difficult and interdependency inherent in many organizational problematic cases. There are three primary types in cognitive mapping technique which are casual mapping, concept mapping and semantic mapping. All these types of cognitive mapping are discussed in detailed in this paper.

Keywords – Cognitive Mapping Technique, Information Development, Technique, Information Development Technique, Methods.

I. INTRODUCTION

System development methodology is a very big area of knowledge and core concept in information system field. There are many methodologies which can be adopted through system development life cycle (SDLC) such as Structured Analysis, design and Implementation (STRADIS), Information Engineering (IE), Web Information System Development Methodology (WISDM) and so on. Under each methodology there are several techniques and methods that would help system development team in adopting the particular methodology.

Thus, this paper describes the selected technique which is Cognitive Mapping, and discusses many issues in regard of this particular technique. Cognitive mapping is classified under Holistic Technique in Information System Development as it is illustrated by [1]. This particular technique has been used in Strategic Options Development and Analysis methodology (SODA). Cognitive Mapping was introduced by Edward Tolman in 1948 [2].

II. DEFINITION

Cognitive map is a model with the “System concept” used to communicate with the environment of an issue, and the concepts are related to others with the action orientation. In influence these atlases show short statement for instance (ideas, assertions and also facts) in relation to the problem situation related by arrows highlighting their interrelationships that is how an idea could trigger or have implications pertaining to another [1].

A cognitive map also called mental guide or emotional model is a kind of mental portrayal which serves someone to acquire, code, keep, recall, and decode details about the attributes of phenomena within every day or metaphorical spatial environment. It has been studied in numerous fields, such as psychology, education, archaeology, planning, geography, cartography, architecture and history. As significance, these mental prototypes are often referred to, variously, as cognitive maps, mental maps, scripts, schemata, and frames of reference [2]. It seems as an official technique that has several procedures for the development.

Within more general phrases, a cognitive map can be defined as "an all-round mental image or representation from the space and layout of a setting", which signifies that the act of cognitive mapping is actually "the mental structuring process leading to the creation of a cognitive map" [3].

Cognitive map can be relatively big with 100 nodes and it can be combined concluding up with over 800 nodes. However, there is software called Decision Explorer. This software can be utilized by a team adopting Cognitive mapping; it helps the team in drawing maps and identifies clusters of
nodes [1]. It allows you to detect views and ideas to discover them and earn a new understanding; the below figure 1.0 shows the interface of the software.

![Decision Explorer Software](image)

**Figure 1.0: Decision Explorer Software**

### III. COGNITIVE MAPPING METHODS

Huff (1990), who edited an early seminal book on the topic, identified five ‘generic families’ of cognitive mapping methods that may be arranged along a continuum. At one end of the continuum are those approaches that analyses the explicit content of cognition, whilst at the other end are those methods that attempt to glean the tacit, more hidden, parts of mental maps. Huff recognized that the boundaries between these families are permeable and that in practice cognitive mapmakers often use more than one approach. Indeed, since Huff devised the typology the borderlines between the approaches have blurred considerably, but they do enable us to see a variety of foci prevalent in contemporary cognitive mapping. The first method focus upon the frequency of attention given to key concepts and from this makes inferences regarding the cognitive understanding of the respondent. A second category consists of cognitive maps that show dimensions of categories and cognitive taxonomies. This is where cognitive maps are used to investigate relationships that are more complex than those that can be analyzed by simple association or concept frequency. This method has often been used in relation to understanding management strategy and with a view to improving decision-making. A third important method of cognitive mapping, and hitherto the most widely adopted, is the cause map which aims to show how people think by constructing a hierarchy of cause and effect. According to Huff’s taxonomy a fourth type of cognitive map is strategic argument mapping that, “attempts to show the logic behind conclusions and decisions to act” [1]. This approach is close to cause mapping in form but focuses more upon the weighing up of evidence behind decisions to act. The final member of the family is mapping that specifies schemas, frames and perceptual codes. Underpinning this method is the basic idea that, “cognition is guided by mental frameworks that are not completely accessible to the individual involved” [1]. This method argues that our cognitive maps are highly influenced by previous experience and routines in ways of which we are not always fully cognizant. The transformational capability of cognitive mapping, through the process of explication, has led some to argue that it holds out the prospect of being able to glean tacit knowledge, the key element of much theorizing about contemporary business [1].

### IV. UTILIZATION OF TECHNIQUE AND IN WHICH PHASE OF SDLC

Most of human actions are based on their customs and habits; they are not considered but performed spontaneously. Thus, Cognitive map captures the important statement which represents contrasting ideas. Also, cognitive map tries to imitate the need for action or handling the problem [1]. Each impression stated by people changed to short statement in the cognitive map that is act or problematic solving-oriented within a sequences of short talks or debates. The arrows connect options to wanted outcomes, with the top levels in the order expressing important aims. Moreover, the map should continue in terms of the clients’ thinking not that of the adviser. Also, the clients should still own it and concern it as a fair picture of the scenario as they see it [1].

Therefore, the phase of Requirement Definition in SDLC can gain a lot of benefits by utilizing Cognitive mapping technique.

### V. TYPES OF COGNITIVE MAPPING

In cognitive mapping technique we have three types. Cognitive mapping technique has been extensively adopted upon various fields such as “political, sociology, organizational behaviour, and strategic management”. A limited available research has produced complete evaluations of three common cognitive mapping techniques in Information System [4].
Causal Mapping: this type of technique is the most usually utilized cognitive mapping technique by academician while exploring the thought of “decision-makers” in a business. This particular type of cognitive mapping symbolizes a fixed of causal relationships between builds inside an information system for example single idea is related to others over cause–effect associations. Figure 2.0 shows an example for Casual Mapping [4].

Concept Mapping: this type of cognitive mapping is a diagrammatic symbol where every node mean idea and match characterizes the relations among ideas. A relation, with tags to show a kind of association among components, two ways are applicable “one-way, two-way”, or non-directional. The advantage of concept mapping is producing new thoughts, designing a complicated frame and so on. Figure 3.0 indicates an example of concept mapping [5].

Semantic Mapping: the third type of cognitive mapping is semantic mapping, sometimes called the map of ideas or thoughts. It has been utilized in discovering knowledge outer of the restrictions of a superimpose frame. This type of cognitive mapping needs single fundamental idea linked with each other like the style of tree. Figure 4.0 illustrates an example for that [5].

VI. ADVANTAGES OF COGNITIVE MAPPING TECHNIQUE

There are many advantages of this technique such as the ability to concentrate on the problem, helps in highlighting significances and main issues, it could provide forgettable idea and discover the main ideas that are essential and must have straight consideration [6].

VII. REAL WORLD EXAMPLE

After going through a lot of literature on Cognitive mapping technique to come up with a real word sample for Cognitive mapping; I have found a research written by [4], the title is “Cognitive Mapping Techniques for User–Database Interaction” researchers improved a framework of user database interaction. After developing a frame for user database interaction they proposed that, utilizing Cognitive mapping technique is the best technique which will help to cope many cognitive and behavioral prejudices throughout users’ database interaction [5]. The framework is indicated in figure 4.0. The framework shows that many human factors may influence the efficiency of users’ database interaction. It is very vital to have the best understanding of these human factors in improving or developing users’ database interaction [4].

As we know user database interaction includes three main responsibilities which are “database
design, database update and database retrieval”. The researchers’ focus was on the regular users’ communication within the system of database. It is known that, the core requirement of users from the database system is retrieve the data, which is commonly adopted by typing the queries on the database system [4]. After that they discussed the issue of “how human factors affect all four dimensions of users database interaction” which are “content, constituent structure, syntactic structure, and style” as indicated in figure 4.0 [4]. The examples that I have explained in the three types of cognitive mapping are related to the real world example which is “use cognitive mapping to improve user database interaction”.

![Figure 5.0: framework for user database interaction](image)

**VIII. CONCLUSION**

To conclude this paper, it can be seen that Cognitive Mapping is most important when developers are trying to find out the significant and crucial points in a system. Also cognitive mapping technique supports developers in determine system requirement definition. In this paper I have demonstrated about cognitive mapping providing the definition, execution of the technique, types of the technique, and advantages of the technique and lastly illustrating real world example for this particular technique.

**References**