THE MOTION PICTURE PARADIGM FOR MANAGING INFORMATION

A Framework and Approach to Supporting the Play and Replay of Information in Computerised Information Systems

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Abstract: The ability of Information Systems to provide a continuous, on-the-fly and playable *information scene* for any specified review period of arbitrary time granularity would help to enhance the reporting and decision-support capabilities of CIS. This paper presents a new paradigm, called the *motion picture paradigm,* for information management. The paradigm views an organisation's database and information system as a mechanism for recording *motion pictures* of organisational information scenes that can be queried and presented through on-the-fly, dynamic and interactive play and re-play operations.

1 INTRODUCTION

A key goal for computerised information systems is to facilitate an easy production of reports that present decision-support information to organisational management. Typically, such reports are periodic reports that give only a snapshot of the status of an organisation at a particular date. Combining information visualisation and databases would present huge benefits in terms of information organisation, presentation and interpretation (Owor 2002). While live interaction (Wesson and Warren 2001) and visualisation (Shen and Eades 2005) of data have been investigated, the ability to provide a permanent live interactive record of information that can be queried, played and replayed has not been investigated thoroughly up to now.

This paper presents a new paradigm, called the *motion picture paradigm*, which views an organisation's database and information system as mechanisms for recording dynamic and interactive motion pictures of organisational information. The dynamic and interactive playing and replying of *information scenes* is a key aspect of this paradigm and perspective to information and knowledge management. In this paper, *information scene* is defined as a multi-dimensional information space whose composite elements and dimensions interact dynamically to make up a meaningful domain information scenario that can be formally specified.

Experience from our earlier work (Wu, Mansour et al. 2007; Dube 2004; Wu and Dube 2001) reveals that presentation, analysis and review of information can be significantly simplified and enhanced through a new paradigm that combines information visualisation with allowing information to be managed, played and replayed in a dynamic and interactive manner on the basis of a formally constructed and meaningful domain *information scene*.

2 RELATED WORK

The concept of playing information has been investigated in a number of application domains. Consequently, a number of approaches and methods of supporting information play and replay has emerged (Manohar and Prakash 1994; Ronsse and Bosschere 1999; Brown and Patterson 2002; Kwon

and Song 1999; Greenhalgh, Pubrick et al. 2000; Ouyang, Li et al. 2003; Crowley 1996; Steven, Chandra et al. 2000). However, it can be noted that the concept of *replay* has not yet been fully investigated in the context of data and information management.

The need and benefits of a new framework and paradigm that incorporates *playing* and *replaying* of information is best appreciated through Hans Rosling's GapMinder presentation software for interactive animated multi-dimensional visualization of development statistics (Rosling, Rosling Rönnlund et al. 2005).

Our work investigates the support for replaying information scenes from real-time systems based on query-response approach that allows playable scenes of information to be composed on-the-fly based on the query specifications.

3 THE MOTION PICTURE PARADIGM

The key question that we pose here is: *Is it possible to support the capture of data during day-to-day organisational operations while at the same time dynamically constructing and presenting the complete information "picture" or "scene" such that the effects of the data or information changes would form a natural aspect of "motion" within the complete information "picture" or "scene"?*

The *motion picture paradigm,* therefore, aims at capturing, generating, mining and discovering all information or knowledge elements that would constitute a complete "information scene" including dynamic interconnections between these elements and these "scenes".

A key aspect of the paradigm is the concept of an *information scene* and its manipulation, especially its visual presentation to human senses. Thus, the question arises of the ability to specify a request or query for the *information scene*, compose it on-the-fly and then play and replay it.

4 FRAMEWORK FOR SUPPORTING THE MOTION PICTURE PARADIGM

Figure 1 presents authors' framework that would allow the *Motion Picture Paradigm* to be supported within information systems. The key dimensions,

which are also components that make up the framework for managing complex information are: *environment, time, information, process* and *knowledge*. Within a given *environment* and *time* frame, the body of organisational *information* moves from one state to another under dynamic impacts of organisational *processes* within the contextual framework of the existing *knowledge* within the organisation. Under such a framework, best practice can be formalised based on experience and knowledge and then applied to processes and information, which in turn would enrich it. Processes and information interact and mutually impact on each other as they move along possibly multiple dimensions, e.g., time and other domain-specific dimensions. Motion in information scenarios could then be realised and explored along any of these dimensions. Thus, dynamic "information scenes" may be composed and manipulated, creating a foundation for the motion picture paradigm for managing the information.
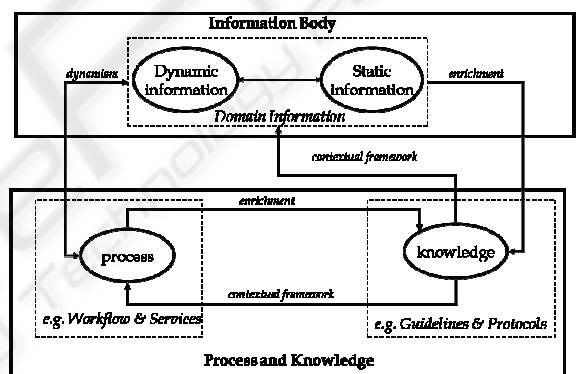

Figure 1: Framework for the multi-dimensional management of information.

5 APPROACH TO REALISING THE MOTION PICTURE PARADIGM WITHIN THE FRAMEWORK

Figure 2 illustrates a scheme for supporting the *information scene.* In this scheme, the information scene (S) is supported by the three dimensions of the framework, namely, information (I), processes (P) and knowledge (K), as well as an extra dimension called meta-information (M). Meta- information (M) consists of information about the other dimensions K, I and P as well as the information scene (S). Suppose we want to *play* the information scene S: *"What transpired, from a drug versus vital signals*

perspective, before a patient started experiencing a severe complication". We would require information on P: "The treatment regime's execution process up to the point of interest", I: "The electronic patient record", K: "The best practice
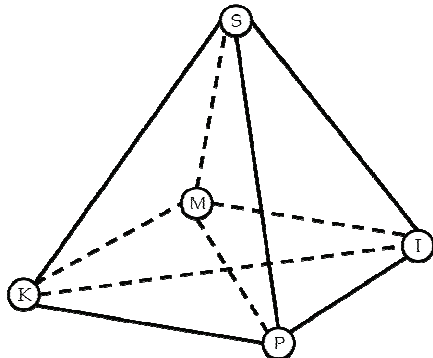
K – Knowledge;   I – Information; M – Meta-Information;   P – Process;   S – Information Scene

Figure 2: Supporting the "information scene" through four dimensions.

knowledge used", and M: "Schemes, definitions and specifications associated with S, K, I, M and P". A comprehensive information scene S could be composed using data analysis, mining and discovery techniques and formally specified based on some meta-information (M) schema. Thus, the resulting specification is a copy of an information scene that can be manipulated, shared and *played back* using information visualisation technologies.
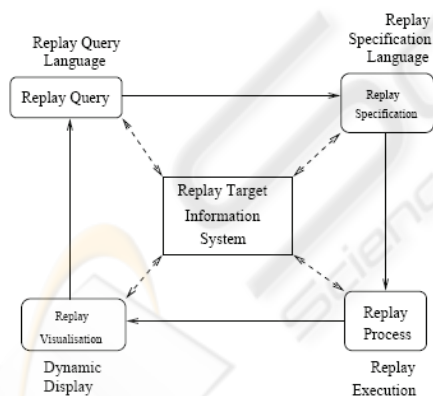

Figure 3: Conceptual scheme for supporting playing information within the motion picture paradigm.

Figure 3 illustrates the conceptual scheme for generically supporting replay for a target information system. A play request is presented as a play query that specifies what aspects of the information are required to be played. Parameters and conditions may be used to characterise aspects or dimensions of the information to be played. Such

a query could be specified by the use of what may be termed as an *information play query language*. An analysis of the play query together with mining and discovery processes leads to a detailed specification of the playable information scene, which is expressed in a play specification language. Such a specification would be submitted to an information player and used to create the play process and visualisations, which is effectively the execution of the replay specification. The replay process would then present, as a response to the user's query, the information play visualisation.

6 APPLICATIONS OF THE MOTION PICTURE PARADIGM

Application domain of our work so far has mainly been focused on supporting the management of complex information in computerised clinical practice guideline systems. The Motion Picture Paradigm was initially applied to the TOPS system (Wu and Dube 2001; Dube 2004) on top of an active database system and, further developed recently to the AIMS system implemented with XML and, an active database system enhanced with temporal features (Wu, Mansour et al. 2007).

A clinical practice guideline (CPG) is a systematic set of statements that result from the formalisation of evidence-based knowledge for guiding clinicians and patients on how best to manage patients' conditions. In our work, formal specification languages are developed for CPGs using the active rule paradigm as a core primitive. The guideline execution engine is an active electronic healthcare record system based on an active database. CPG specifications are stored and maintained over time to accommodate changes and improvements in best practice knowledge for the relevant disease category. From the user's standpoint, a submission of information replaying query leads to the dynamic visualisation of the information visualisation. Thus, the information replay query is submitted to a *replay command processor,* which incorporates data analysis, information mining and discovery modules to aid the composition of the playable information scene. The information replay execution engine uses the information scene specification to instantiate the required play process, which is presented to the user through a *play visualisation module.* Our preliminary experience of this approach has proved promising and pointed to a need for a more vigorous

investigation towards fully realising a comprehensive implementation of the framework and applications of this paradigm in other domains.

7 BENEFITS AND FUTURE WORK

The ability for computerised information systems to provide a continuous, on-the-fly, dynamic, playable and visual "information scenes" for any specified period of arbitrary time granularity would:

1) help organisational management to apprehend fully the state of affairs in their organisation;
2) allow trends in information to be easily understood;
3) facilitate important questions to be posed and answered;
4) facilitate the creation of reports at any time during business operations.

This work is of particular benefit to the domain of healthcare where the task of point-of-care review of a patient's medical record is made faster and easier than otherwise if the information were playable from multiple dimensions

The work presented here is part of on-going work. The core concepts and methods of the new paradigm and framework are under further investigations aimed at giving them a more firm and formal grounding. A more comprehensive implementation of the proof-of-concepts prototype system is in progress focusing on the domain of clinical practice protocols. This will lead to evaluation of the core concepts, methods and approach with assistance from domain experts.

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