

# Space-time configuration for visualisation in information space

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## Abstract

This paper investigates placing the time-history events of a project related folder produced by a project team in a virtual linear spatial configuration, in order to reveal the usually hidden relationships between separate strings of information.

We demonstrate the possibility of exploring the history of the events that have taken place on documents in a project folder, as various members make changes to its content, through explicit spatial syntactic relationships. Further more we provide a tool for managing and inspecting the folders contents: the DocuDrama Timetunnel.

Here we present preliminary findings showing how spatialised time-history visualisation may lead to a better understanding of the project related events history.

First we outline the motivation and strategy for this approach, followed by a description of the approach and the three-dimensional model with the representation of the various DocuDrama elements. The section on implementation specifies a range of interfaces available in the DocuDrama architecture. Finally, we give an account of example configurations for different three-dimensional DocuDrama models generated, using data from the TOWER<sup>1</sup> application partners. This specification has been implemented as a full prototype, which forms one of the main components in the TOWER environment.

## Key Words

collaborative work, visualisation of events history, virtual environments, management tool, dynamic interactive architecture.

## Introduction

For effective collaborative working it is essential for teams to be able to access records of meetings minutes, documents histories and decisions made. It is also essential that new members of teams are able to catch up with what has happened in order to get a clear picture of the state of a project. Although many systems are available for recording changes to documents, it can also be difficult for team members to fully understand the context in which decisions were made or documents were changed [1].

We present the DocuDrama prototype, which aims at capturing the history of workspace events and activities generated by a project team in a collaborative work environment.

The prototype is driven by the Event Notification Infrastructure, ENI [2]. ENI provides a set of methods to capture activity events (e.g. create document, read document and delete document) that have taken place in folders within the workspace. The log of

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<sup>1</sup> a Theatre of Work Enabling Relationships. It allows project members to be aware of project relevant activities as well as to establish and maintain the social relationships with the aim to provide, distributed teams with spontaneous communication capabilities close to those of co-located teams.

user interactivity with the information system provided as ENI events is sufficient over time to generate a map of the folder's history. The strategy that has been adopted by the DocuDrama proto type is to take advantage of this to generate a time-space configuration, in which past events are aggregated in the form of a three dimensional environment. The three-dimensional models could be built on various events and actions, which would generate different results from the same data depending on user preferences.

### **Narrative and DocuDrama**

The function of narrative is two fold: reporting on events and putting these events into a meaningful whole [3]. A narrative may thus be seen as a way of making sense of the captured events by integrating them into a meaningful whole that makes the events comprehensible in relation to the context of what had happened.

In a similar way the DocuDrama Timetunnel tells a story of the life cycle of a team's workspace. In this prototype a 'meaningful' symbolic representation of events history is constructed by implementing a spatial approach that aggregates events and elements together in a chronological sequence as a configuration of related events. Thus events that take place at the same time period will be interlinked and appear in the same time segment (Figure 2).

Moving through the tunnel enables a virtual journey through the project's lifetime, from the furthest date to the most recent one.

The stories presented in the DocuDrama, are dynamically generated and do not follow a story line. Events are aggregated in the form of a three dimensional environment, providing team-members with a generative tool to visualize projects events history in various configurations.

### **Approach**

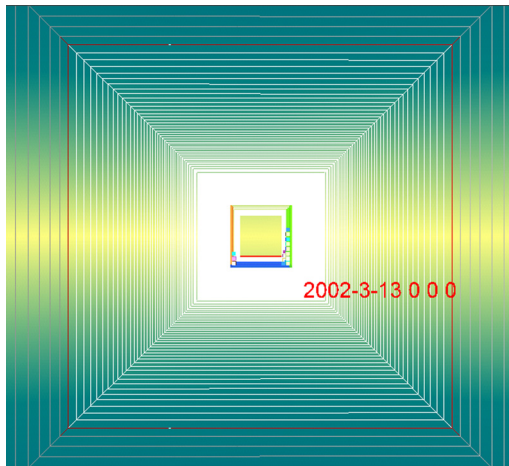
The DocuDrama Timetunnel as a feature of the Theatre of Work focuses on the mapping and visualisation of events that take place in the TOWER multi-user, virtual environment [4]:

Subjects of mapping in this case are information objects and their changes over a period of time. To illustrate the model's functions, the following scenario explains one possible use of the DocuDrama tool in the TOWER context:

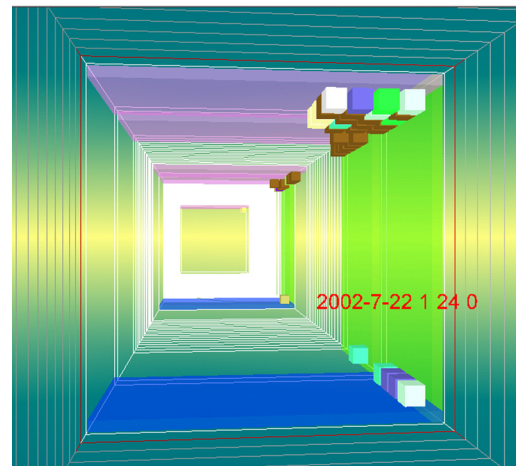
Mike a manager of a team that deals with a particular part of a big project has been away for two weeks at a workshop. He needs to check the history of the management folder during his absence in order to get a quick overview of the development, e.g. if there have been an important event that might effect the progress of the project. He clicks on the DocuDrama symbol in the TOWER portal (Figure 6).

In the configuration interface, he selects '14 days' as the period to examine, and defines a 'daily' level of detail. He then specifies that he wants to view the DocuDrama tunnel for the designated folder built on events producer, colouring the documents based on artefacts.

Finally the DocuDrama three-dimensional model will be generated, visualising the selected folder including the activities and events that with the project related deadline (Figure 1 and 2).



**Figure 1** Visualising project events history



**Figure 2** Boxes with the same colour refer to the same document

### Components overview

The DocuDrama Timetunnel went through different phases of evolution. The final version of the proto type features the following:

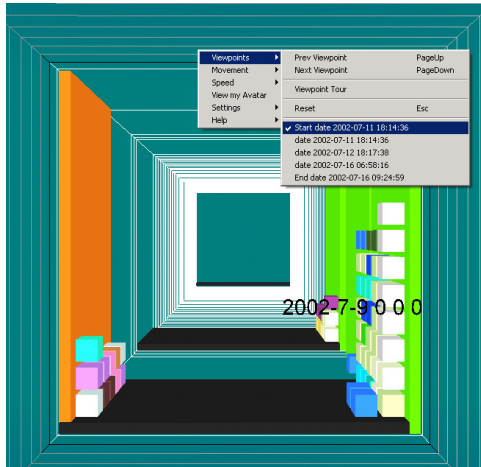
- Three-dimensional time segments, which might represent years, months, days, hours, minutes or seconds depending on the selected interval in the configuration interface. A short time segment represents a time period with no activity (Figure 4 and 5).
- Actions and events in the DocuDrama proto type are organised in the tunnel around the axis of movement forming the tunnel's walls. These walls have different colours depending on the kind of actions they represented (Figure 3).



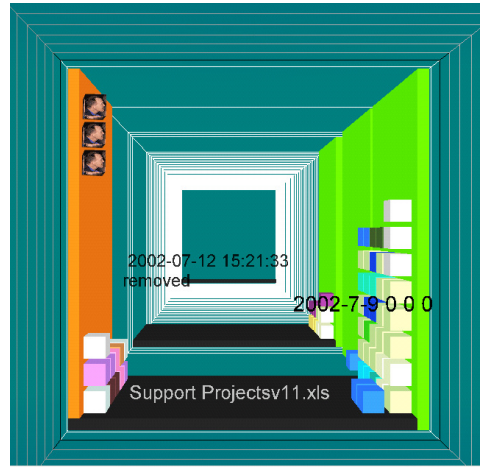
**Figure 3** Actions and events types in the DocuDrama tunnel

- Activities that have taken place on the same day are located in the same time segment. When the user clicks on a selected wall, information about the date and the event type that is represented by this wall will be displayed. (Figure 5)
- Folders and documents are represented small boxes placed on the wall of a time segment and covered by an image of the event producer: By clicking on the designated document, users can retrieve the document's name (Figure 5).
- User location inside the tunnel is illustrated by a red wire frame. Each time the user approaches a time segment the correspondent three-dimensional frame will be highlighted displaying the correspondent date (Figures 1).

- Movement through the tunnel is a journey through time, in which the tunnel symbolizes the time axis of the project. Navigation through the tunnel is facilitated through the use of viewpoints that transport the user to the desired location (Figure 4).



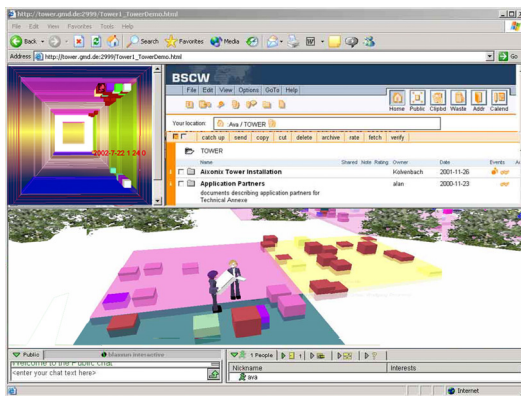
**Figure 4** Navigation in the tunnel is facilitated through viewpoints



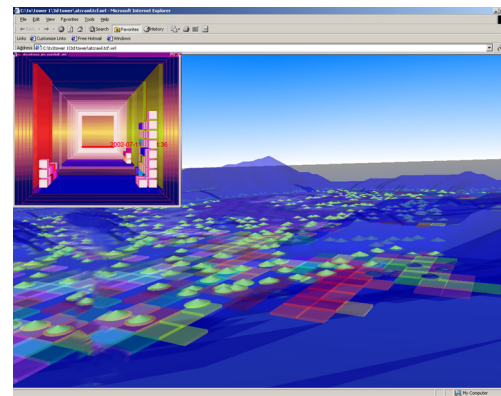
**Figure 5** Clicking on the document will display the document name

## Implementation

The DocuDrama proto type could be accessed either from the project demo site (Figure 6) or from TOWER world (Figure 7) in the TOWER portal. It could also be accessed via a web based management interface.



**Figure 6** DocuDrama within the TOWER demo site



**Figure 7** DocuDrama within the TOWER environment

The configuration interface allows the user to generate different representations from the same project data for each proto type depending on the user's preferences: e.g. the type of actions, the producer of action or the time period. Consequently this will affect the temporal and contextual properties of the displayed information.

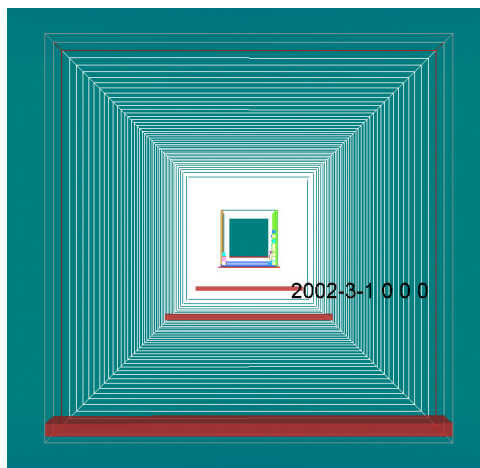
Two configuration interfaces are implemented for flexibility of use as follows:

- One is directly implemented in the mapping engine for standalone operations and testing.
- The second interface can be externally accessed via a web based management interface.

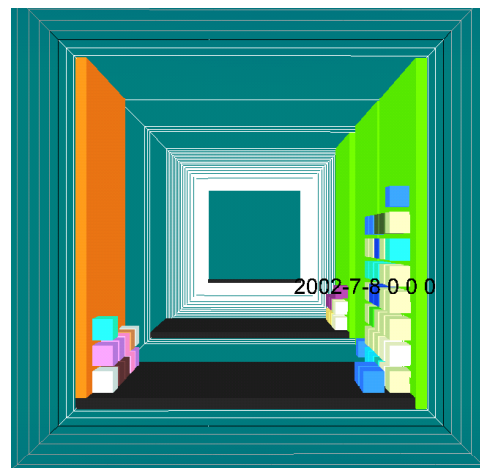
The mapping of the underlying information structure is executed on the basis of a specific and fixed placement rule. This is performed by integrating different software modules into one dynamic system. The shared workspace server connects to an Event Notification Infrastructure ENI, which passes the event data via standard http call to the DocuDrama creation proto type. The proto type processes the event data into a three dimensional visualisation of the information space, reflecting a time-space configuration of the events that have taken place in the past in the designated folder. The Software is written in VRML, Perl and C++ respectively [5]. The configuration interface is implemented in Perl-CGI scripts and provides access in a Mysql backend database.

## Results and future work

The system was installed at the application partner site in June 2002 successfully. Consequently experimental trials were conducted and the prototype was tested to visualise various history events along with the related milestones (Figures 8 and 9).



**Figure 8** Visualising the project related deadlines and milestones



**Figure 9** Visualising the folder's events history

Our findings indicated that the three dimensional model, which visualises space-time configuration of events history, is easier to understand than textual list of events history.

Further more the user group has indicated that the DocuDrama proto type represents an excellent tool for project control and post-project reviews, particularly if compared with planned milestones and deadlines. However the user group pointed out that it was hard to understand complex symbolic representation, which would suggest a need for an automatic focusing on areas of interesting activity if tool is to be useable in real environments.

Currently events mapping is executed on the basis of fixed placement rules, within the mapping engine, representing only four events types. Future research and development will focus on the handling and visualisation of large datasets in the Timetunnel. To improve the functionality of the model we plan to experiment with context analysis and with different types of spatial clustering in a form of a parametric mapping of space-time configuration, which would reflect the actual number of events that took place at the specific time segment. Consequently the user would be able to detect and identify the period of high activity at a glance, as the associated time

segment will be bigger than the time segment defined during the period of low activity [6].

## Conclusion

This paper describes a novel approach for generating and visualising events history in a collaborative virtual three-dimensional information space. We introduced the DocuDrama Timetunnel; a new type of a dynamic interface, in which a three dimensional virtual model serves as a stage for visualising the history of project related activities through explicit spatial syntactic relationships.

A set of tools have been realised to deal with different aspects of constructing and mapping event histories. Consequently a range of interfaces and configurations for the DocuDrama prototype has been developed.

The prototype provides an efficient and entertaining way of illustrating the history of project-relevant events and activities together with milestones and deadlines. It is especially suited as a management tool for inspecting project related folders and managing them.

Finally in developing the DocuDrama Timetunnel we have created a folder management tool as part of TOWER, a Theatre of Work Enabling Relationships.

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