

Symbolic Activities In Virtual Spaces

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ABSTRACT

This paper presents an approach to combine concepts of symbolic acting and virtual storytelling with the support of cooperative processes. We will motivate why symbolic languages are relevant in the social context of awareness applications. We will describe different symbolic presentations and illustrate their application in three different prototypes.

Keywords

Symbolic Acting Storytelling, Collaborative work, Virtual Environments, Awareness, CSCW

1. INTRODUCTION

For effective collaborative working it is vital for teams to be able to access records of decisions made, minutes of meetings and document histories. It is also vital 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. Whilst many systems are available for recording changes and amendments to documents, and minutes are written recording decisions and actions at meetings, the information gleaned from these sources can be very sketchy. It can also be very difficult for team members to fully understand the context in which decisions were made or documents changed. For full understanding of what has happened it is necessary to perceive the course of events including the activities of actors [25],[29].

This paper describes three approaches on DocuDrama, three applications which offer generation of interactive narratives that are based on awareness information recorded on activities in a collaborative virtual environment. DocuDrama [26] has been developed as part of TOWER [24] a Theatre of Work Enabling Relationships, which allows project members to become aware of project relevant activities as well as to establish and maintain the social relationships that intensify team coherence.

2. Challenges

In asynchronous cooperation, co-orientation needs technical support of awareness. In particular awareness [13] about the ongoing work processes and of the activities of the partners are requested similar to workspace awareness in real-time groupware [17]. Such support requires the recording of events [23] and a presentation of the episodes of action. The challenge of DocuDrama is to compile episodes from the stream of events recorded and to present them to the user in an intuitive way.

DocuDrama as a feature of the Theatre of Work focuses on the recording and replay of events. The creation of stories in DocuDrama sets up on the recording of cooperative activities in a team's shared environment. The recording of events results in history files, which contain the event information as abstract data sets. The challenges for DocuDrama in generating narratives of project histories are threefold. The first challenge is to sort and select meaningful events, to combine and aggregate this data and finally, to derive a meaning from the event sequences. The second challenge is to find a meaningful way of presenting the event data to the user. The third challenge is to present the project's history and progress in an entertaining way which captures the users' attention and conveys complex information fast and effectively.

In the following we will take a closer look on the methods of storytelling, introduce the concept of symbolic acting and describe the symbolic languages applied in the different DocuDramas.

2.1 Narratives

Narratives consist of story and discourse [10]. Story is thereby the content of narrative (what is told), while discourse is the medium that conveys the story (how is it told). A story is a sequence of events - actions and happenings - that are causally, temporally and spatially connected to each other. A story also contains characters and settings.

Stories can be communicated by many means, e.g. by language (both, oral and written), in images (both, fixed and moving), in gesture and movement.) They are present in many forms and therefore many discourses, e.g. conversation, novel, painting, film, pantomime, theatre, etc.

In DocuDrama the story is based on a sequence of events which result from activities of team members in a shared workspace. The different DocuDramas represent different discourses, all with another focus on the presentation of the story.

2.2 Storylines

The stories presented in the DocuDramas are dynamically generated. Stories told by traditional media usually follow a storyline. In film or theatre for example, there is a clear sequence of events which creates suspense and involves the user in the story[1]. Stories in DocuDrama based on a sequence of user activities in a workspace do not contain an inherent storyline. The dynamic generation of narratives which captures the users' attention and conveys complex information fast and effectively represents one of the major challenges to DocuDrama. There have been several approaches on the

dynamic generation of narratives, but no approach is known which uses a DocuDrama combination of research areas.

Temporal Links [16] introduces the idea of a flexible mechanism for replaying past or recent recordings of virtual environments within other virtual environments. Temporal Links is concerned with time, spatial and presentational relationships between the environment and the recording. Where Temporal Links focuses on replaying the past and its implications with the current environment, DocuDrama is concerned with selection and aggregation of history events and their replay depending on the user's situation.

Brooks has investigated with Agent Stories [6; 7] a model for the computational generation of narratives. This model splits the task into: defining an abstract narrative structure, collecting material and defining a navigational strategy. While Brooks offers a story design and presentation environment for non-linear, multiple-point-of-view cinematic stories, DocuDrama focuses on the automated generation of narratives by selection and aggregation of events.

2.3 Symbolic Acting

The idea of Symbolic Acting is to 'Let the system do the walking'. The system automatically records the user's activities and presents them symbolically in a virtual environment. The emphasis in symbolic acting is to show the contextual information telling us about where a user is, who they are and what they are doing right now, what documents they will use and what happened to documents.

Symbolic Acting takes away the responsibility from the user to navigate in a virtual environment or to control an avatar. The user is able to follow the events in the virtual environment as in a theatre, the system acts as a guide.

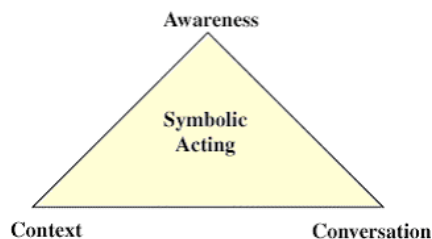


Figure 1: The Symbolic Acting Triangle

Symbolic acting enables the user to become aware of ongoing activities in the virtual team's work environment. It provides context on the activities of other users and encourages conversation on the current events (Figure 1).

The term Symbolic Acting was first used by BT in its project Forum [18] which aimed to show what each member of a connected group was doing by detecting their activities and representing these online in a clear, symbolic form. Symbolic Acting formed an important component in the project TOWER [24], where it was applied to present events in the TOWER virtual environment.

In the DocuDramas we employ Symbolic Acting in two different ways. At first we focus on symbolizing events in form of environmental cues. Thereafter we will introduce Symbolic Acting with avatars and present two DocuDramas based on this

approach on Symbolic Acting. We will detail the employment of Symbolic Acting in the respective sections on DocuDrama.

3. THE DOCUDRAMAS

We present three different foci on DocuDrama, which represent user activity in a project workspace. The first DocuDrama symbolizes activities in their temporal structure in a time tunnel. The second focus lays on symbolizing the activities with respect to project context and goals to be met. The third focus takes the social perspective and symbolizes an activity as social relationship among the actors.

3.1 DocuDrama Timetunnel

In DocuDrama Timetunnel events are symbolized by means of environmental cues. To this end a space language provides a time-document-centred view in DocuDrama Timetunnel. The Timetunnel tells a story of the life cycle of a team's workspace. It visualizes folders and documents, deadlines and milestones. The aim is to provide an abstract view on related activities and to offer the functionality to manage data. The Timetunnel shows a symbolic space, the virtual representation of a project team's shared workspace (Figure 2). Moving through the tunnel enables a virtual journey through the project's lifetime, in which the tunnel symbolizes the time axis of the project.

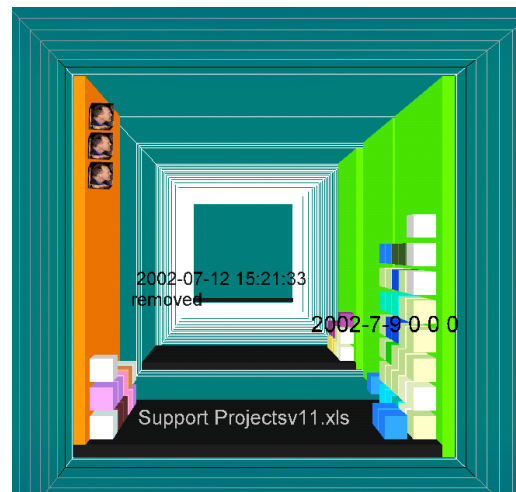


Figure 2: The Timetunnel

Small boxes placed on the wall of a time-slice symbolizes interaction with the project's folders and documents. Each box represents a document. The position of the box inside the time-slice indicates the form of interaction with the document. For example, boxes piled up on the right side of the time-slice might represent documents which have been opened for writing, boxes on the ceiling show documents which have been opened for reading. The colouring of the walls supports the meaning of the position.

Based on action events [24] over time a map of the folder's history is generated. Past 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.

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.

In order to reveal the usually hidden relationships between separate strings of information, the events of a project are placed in a linear time-based spatial configuration, with the objective to create meaningful relationships between separate strings of events. The events that take place at the same time period will be interlinked and appear in the same time slice. In addition the documents could be coloured. This means that the box, which represents a specific document, will have a certain colour e.g red. It will keep the same colour, independent of the type of action performed on it. Its location inside the Timetunnel will be changed depending on the type of action performed on it.

Actions, events and milestones in the Timetunnel are arranged around the axis of movement forming the four surrounding walls. These walls have different colours depending on the kind of actions they represent.

Activities that have taken place on the same day are located in the same time slice. To display the information (date and the event type) that is represented by a specific wall, the user should click on the desired wall. The displayed events include read, delete, create, and move documents in a folder, which affect the state of that specific folder.

The evaluation in discussion with possible user groups showed that the DocuDrama Timetunnel represents an excellent tool for task control in case of shared document production. Users said that the three dimensional environment, which visualises space-time construction of event history, is easier to understand than pure textual list of events history. Instead the clustering of events is easier to detect. The user group pointed out that the Timetunnel could prove to be especially useful in relation to deadlines. This would enable the user to monitor the activities and delays in a task.

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 unit. Consequently the user would be able to detect and identify the period of high activity at a glance.

Future work as well will be to refine the up to now quite complex symbolic representation. It will be enhanced with automatic focusing on areas of interesting activity, which both will simplify interaction with the Timetunnel and its content. The future Timetunnel will be useful to monitor the course of a task in relation to overall milestones and project deadlines. In particular it will offer functionality to manage and organize folders.

3.2 Symbolic Actions with avatars

In conversations between people, information is not only transferred by spoken words. Indeed language transmits only half of the message, the other and sometimes even more meaningful part of the message is conveyed through body language. Body language is the first language humans learn. Therefore humans are used to pick up information from the position, behaviour, and appearance of those around us [28]. Over the last decades Social Psychologists such as Michael

Argyle [4] have done much to study the similarities and differences in which we react to crossed arms or a tapped nose or a shrug of the shoulders. Others, such as Desmond Morris [19; 20] have popularised these notions.

Results of these studies have been applied in the research on Embodied Conversational Agents [9]. This research direction focuses on the design of computer interfaces, with which the user can interact in a dialogue, under respect of conversational behaviour, emotion, personality and social convention. The interfaces have bodies, usually human-like, and perform movements of body language [3; 8; 15].

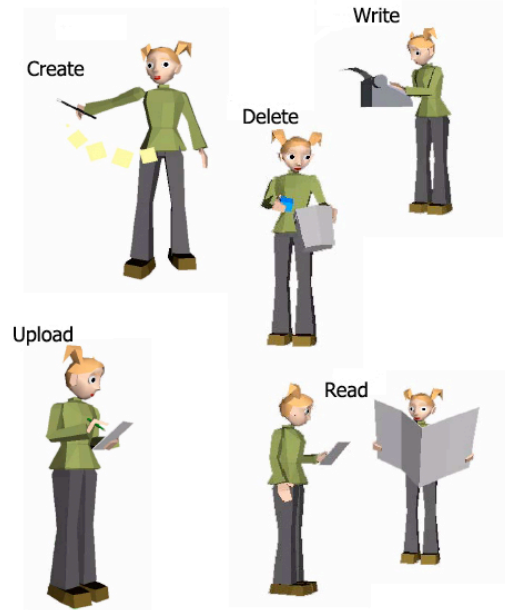


Figure 3: Symbolic actions of avatars

In the DocuDramas presented in the following individual team members are represented through avatars. The avatars perform symbolic actions which are derived from human vocabulary of body language. These gestures are intuitively understandable, enable to transmit the underlying information fast and effectively and at the same time convey a feeling of emotion and familiarity.



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Figure 4: Avatar Customiser

In both approaches, activities of individual team members are represented through symbolic actions performed by avatars. For example, an avatar reading a newspaper symbolizes that the person behind the avatar is currently opening and reading

the spectator to see the world more like a theatre and less than as a simulation of a real world [28].

Another inspirational source for the development of DocuDrama project originates from the game 'The Sims'[2]. In

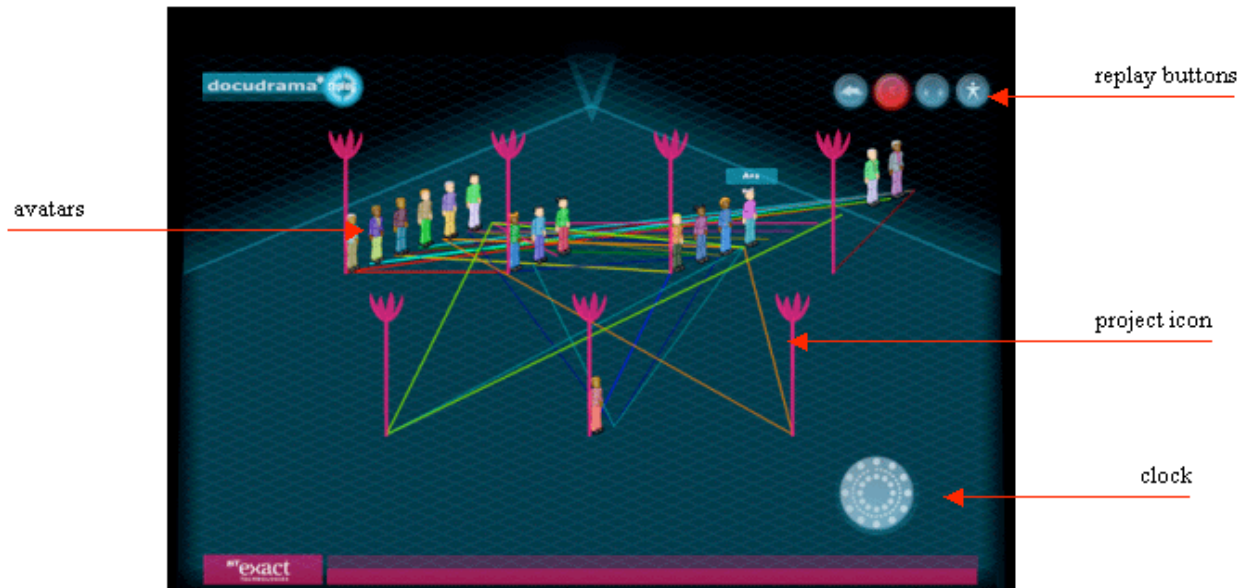


Figure 5 : Project Summary View

documents. An avatar creating a series of stars with its wand symbolizes the creation of a document. Figure 3 shows a selection of the most commonly used Symbolic Actions.

The avatars are configurable and might therefore express the personality of their owners. The user can choose the avatar's hairstyle and colour, formal or casual clothes and two different options for a Symbolic Action. Figure 4 shows the Avatar

Customiser [21], which serves to personalize the users avatars. It has been developed in the course of the TOWER project.

3.3 DocuDrama Project

DocuDrama Project presents team-members with overview scenes of historic events in an axonometric environment. This is a pseudo 3D space in which team-members and projects are represented by 2D interactive icons (Figure 5). The arrangement of the space enables all avatars, and their contextual activity to be seen at a glance. The environment features both symbolic acting and visual annotation (paths) to display activity in the projects.

MobilesDisco, a chat space [22], uses a similar visual arrangement. It offers an axonometric view on a room in which avatars interact and communicate with each other. Some of the avatars represent people, others represent bots. The user can follow the activities in the space from an overview perspective and see his/her avatar interacting with other inhabitants of the MobilesDisco world. This relatively detached view enables

that game the player can look on and manipulate a whole neighbourhood of people. The axonometric view on the room perfectly enables the user to control all activities in the world and manipulate its inhabitants. A task which would be much more difficult to perform if the world would be represented by looking through the eyes of an individual.

Built in Macromedia Flash MX, the interface runs on a client machine and can query local and shared project history files (in XML format). The interface has two parts, a configuration tool for project selection and a review interface. The latter presents the user with the options to refine the time period on display, and to view visual and textual summaries of events in that period. These summaries can be expanded into fully animated replays in which the avatars act out each event sequentially.

The symbolic actions used are renderings of a subset of the animations available in the original TOWER world, of which Read, Edit, Create and Delete are the most commonly detected. The animations involve the use of props to demonstrate the activity using commonly recognised icons – a waste bin for Delete, and a document for Edit. In the case of DocuDrama the avatar is seen to affect the prop in some way (throw the document in the waste basket). The avatars are rendered at a 45 degree angle, camera to the right and above the avatar, to define the most clear silhouette for each action.

The Project world is organised on a grid layout. According to the number of projects selected for review, the relevant number of project icons are automatically generated and arranged on the grid. The program lays out the icons evenly to give the maximum space for each project, and therefore there is no semantic meaning implied. The projects in this prototype are represented by 'flower' icons. The icons are sprites with

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animation properties. A flower which is closed will represent a lack of recorded activity, a more open flower has a higher percentage of use.

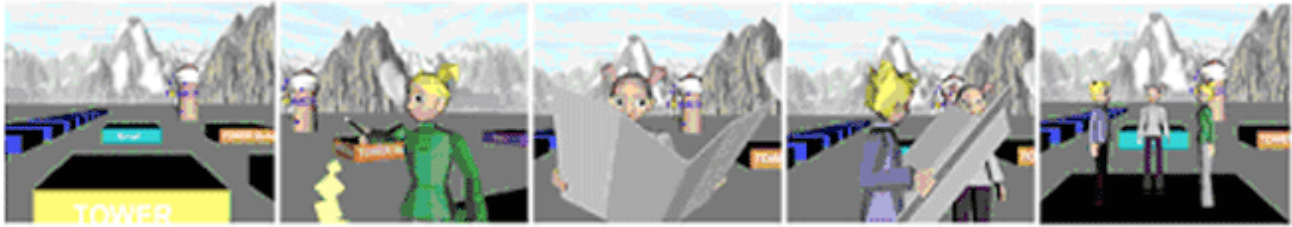


Figure 10: Dialog Scene with three actors

In the summary view, avatars stand in their last recorded context, at the side of the relevant project icon. A uniquely coloured path is associated with each avatar and denotes a summary of where events took place for each individual in the selected time-period. As well as indicating where people have been most active – this annotation enables the user to see where there has been little or no activity. This view is intended as a prompt to drill down into further information cues: the replay of an individual history, or of the group as a whole.

When a replay is activated using the replay buttons, the avatars move from flower to flower and perform the action symbolising their activity within the project (Figure 6). Avatars line up in order of activity in a project. Additional properties i.e. the names of projects and people are available on mouse rollover. These can be clicked on to retrieve a detailed text summary of individual document actions, and statistics on overall project activity. A new time period can be selected using the clock in the bottom right of the screen. The clock incorporates month, day and hour in a circular interface, and has a progress bar to show how far through the replay the user is.

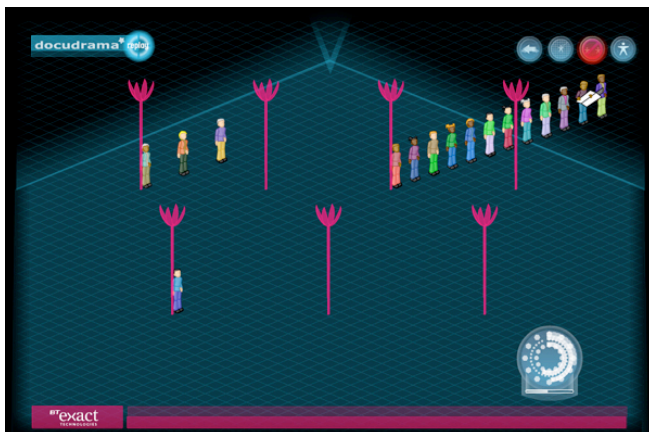


Figure 6: Replay View

The prototype realised has a limited set of features dictated by the data available for tracking events at the time of development. Integration into a project management tool which tracks deliverable status and team resources would be desirable. Feedback has been received from the TOWER user-testing group Atkins, and from teams experimenting with the

interface in BT Exact, which includes project managers. The use of symbolic acting and annotated overviews were regarded as useful when compared to text based history files. We would

seek to reduce the complexity of the animations and develop symbolic poses for speed of use and comprehension, and try to further understand the patterns of interaction over time, for example the intersection of paths could suggest a particular relationship between team-members on a piece of work. Users expressed a wish to interact directly with the progress bar to stop and start replays and to scrub backwards and forwards through time.

3.4 DocuDrama Conversation

In DocuDrama Conversation the social perspective is in the fore. Asynchronous interaction between people should be made visible. Therefore DocuDrama conversation focuses on the interaction between people on occurring on documents [27]. It uses spatial bodily positions and nonverbal communication to symbolize interaction between team members thus disclosing non-verbal communication sequences.

Film and theatre grammars [5; 28] also proved to be an effective resource of inspiration by the development of DocuDrama Conversation. The language of film and camera directing has evolved over the years with the audience. We are now at a point where some relatively subtle signals can convey precise ideas about everything from the weather and the passage of time to the innermost thoughts of a character. The film camera controls not only what we see but also the way how we understand it. A dialogue between two actors can appear like a normal conversation between two persons if regarded in a distance. With a camera close-up switching between the faces it can create a feeling of suspense and tension [12]. Camera controls not only what we see, but also how we see it. It determines our viewpoint, directs our intention, provides sympathy or antipathy to something /somebody, etc.

Certain similarity exists between film and computer graphic applications: both communicate a story mainly in images, both present a 3D world on 2D screen, both control the sensation of the audience by directing the camera[11]. In DocuDrama Conversation we employed film and narrative concepts of cinematography in the development of an automatic camera direction.

The story of the conversations on documents is presented in a three-dimensional virtual environment (Figure 7). The DocuDrama world symbolizes the shared workspace of a virtual team. The coloured and labelled boxes in the virtual environment denote different folders in that workspace. The boxes are coloured differently to symbolize the context of the

folders. For example, the blue boxes in a row all belong to the context 'Workpackages'. The tower in the background serves as landmark and, if the users wish to explore the world by him/herself, as support for navigation [14].

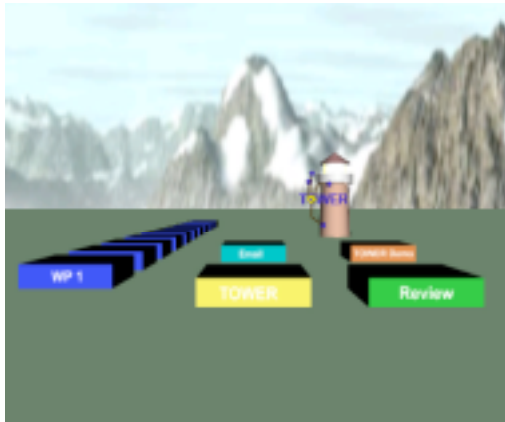


Figure 7: DocuDrama world

People acting on the same document in a given timeslot are positioned on top of the respective document. They are arranged and filmed according to film idioms[5]. For example, two avatars interacting on the same document are positioned in one line and turned to each other (Figure 8). Several avatars interacting on the same document are arranged in a circle thus symbolizing potential collaboration (Figure 9).



Figure 8: Avatars in a dialogue



The DocuDrama camera guides the user through the story of conversations. Cinematography rules are applied to present the story to the user in an entertaining way. The camera direction uses the position 'Medium shot', a camera position between overview on a scene and close-up on actors, in order to direct user attention to an action. It then moves forward to give the spectator a closer look on the symbolic action performed by the avatar. The avatars appear one after the other and perform their action. If there are more than two avatars involved the camera shows their performances first before giving an overview on all participants of the conversation. The camera always moves at the same height as the avatars. Figure 10 shows how a dialog scene with three actors is filmed. First, an establishing overview shot is used to introduce the location to the user, at which the action is going to take place. Then the camera moves forward to show the individual symbolic actions by the different actors. At the end of the scene, a finishing overview shot is used to show at one glance which actors interacted with each other.

Improving the understanding of the collaboration processes is the aim of DocuDrama Conversation. The replay of events in DocuDrama conversation shows the team members' activities over a period of time. The story brings out the centre of interaction on documents in the teams' shared workspace as well as the sequence of interaction between the team members.

DocuDrama Conversation has been evaluated in two experiments with different settings. Both experiments focused on possibilities of a history replay of events. The user experiments have shown that it was easy to identify the most important documents in the work process. The users could easily point out the team members involved in the collaboration process and also the most active participants in the course of events. It was easy for the test users to identify the purpose of the collaboration, e.g. writing a paper because the sequence of events includes several Write, Create, and Read activities. In summary the test users liked the tool, although they criticised the slow motion of the story play-out and the sometimes tiring repetition of avatars performing Read-actions. Future Work will therefore focus on the development of a version of DocuDrama which offers a fast-forward overview on activities as well as a higher density of information.

4. CONCLUSION

In DocuDrama we introduced three different modi to represent project activities and interaction between team members. Each of the approaches uses a symbolic language of its own. They use different signs and symbols to represent project context and project-related events. The DocuDramas are designed to present a project in a specific point of view. Their representation and use of symbols responds to different sets of requirements defined by the user to fulfil a specific task, e.g. to visualize the project's workflow. Depending on the information needs a user may select the most appropriate symbolic visualisation. Although currently there are three different symbolic presentations, all of them are by nature of their visualisations easy to grasp and support intuitive understanding.

Future work will focus on the development of a one-for-all DocuDrama, which combines features of the DocuDrama approaches presented in this paper.

5. ACKNOWLEDGMENTS

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6. REFERENCES

- [1] Dramatica (2003), <http://www.dramatica.com/>
- [2] The Sims (2003), <http://thesims.ea.com/>
- [3] André, E., et al. (2000). The Automated Design of Believable Dialogues for Animated Presentation Teams. Embodied Conversational Agents. J. S. J. Cassell, S. Prevost and E. Churchill, MIT Press: 220-255.
- [4] Argyle, M. (1990). Bodily Communication. London, Rotledge.
- [5] Arijon, D. (1991). Grammar of the Film Language. Los Angeles, Silman-James Press.
- [6] Brooks, K. M. (1996). Do Story Agents Use Rocking Chairs. Fourth ACM international conference on Multimedia, Boston, USA, ACM Press.
- [7] Brooks, K. M. (1999). Metalelinear Cinematic Narrative: Theory, Process, and Tool, MIT.
- [8] Cassell, J. (2000). "Embodied Conversational Interface Agents." Communications of the ACM 43(4): 70-78.
- [9] Cassell, J., et al., Eds. (2000). Embodied Conversational Agents, MIT Press.
- [10] Chatman, S. (1980). Story and Discourse: Narrative Structure in Fiction and Film, Cornell University Press.
- [11] Clarke, A. and G. Mitchell (2001). Film and the Development of Interactive Narrative. ICVS 2001 (International Conference on Virtual Storytelling 2001).
- [12] D.Katz, S. (1991). Film Directing Shot by Shot, Michael Wiese Productions.
- [13] Fuchs, L., et al. (1995). Supporting Cooperative Awareness with Local Event Mechanisms: The GroupDesk System. Fourth European Conference on Computer-Supported Cooperative Work - ECSCW '95, Stockholm, Kluwer Academic Publishers, Dordrecht.
- [14] G.Vinson, N. (1999). Design guidelines for landmarks to support navigation in virtual environments. CHI 99, Pittsburgh, PA USA, ACM Press.
- [15] Gratch, J., et al. (2002). "Creating Interactive Virtual Humans: Some Assembly Required (Special issue on AI in Interactive Entertainment)." IEEE Intelligent Systems 17(4): 54-63.
- [16] Greenhalgh, C., et al. (2000). Temporal Links: Recording and Replaying Virtual Environments. 8th ACM international conference on Multimedia (MM 2000), ACM Press.
- [17] Gutwin, C., et al. (1996). Supporting Workspace Awareness in Groupware. Conference on Computer-Supported Cooperative Work - CSCW'96, Boston, MA, ACM, N.Y.
- [18] McGrath, A. (1998). "The Forum." SIGGROUP Bulletin 9(3): 21 - 25.
- [19] Morris, D. (1967). The Naked Ape, Vintage Paperbacks.
- [20] Morris, D. (1997). Bodytalk. Körpersprache, Gesten und Gebärden. München, Wilhelm Heyne Verlag.
- [21] Oldroyd, A. and J. Bulman (2001) Symbolic Acting Module D 5.2, BT, TOWER Report
- [22] MobilesDisco (2000), www.mobilesdisco.com
- [23] Prinz, W. (1999). NESSIE: An Awareness Environment for Cooperative Settings. Sixth European Conference on Computer Supported Cooperative Work (ECSCW '99), Kopenhagen, Kluwer Academic Publishers.
- [24] Prinz, W., et al. (2003). Presenting activity information in an inhabited information space. Inhabited Information Spaces. E. Churchill and D. Snowdon.
- [25] Prusak, L. (1997). Knowledge in Organizations. Oxford.
- [26] Schäfer, L., et al. (2001). Virtual Storytelling of Collaborative Activities in a Theatre of Work. International Conference ICVS 2001: Virtual Storytelling, Avignon, France, Springer.
- [27] Schäfer, L., et al. (2002). DocuDrama Conversations. SIGGRAPH 2002, San Antonio, Texas, USA, ACM.
- [28] Smythe, P., et al. (2000) Symbolic Acting Module D 5.1, TOWER Project, TOWER Report
- [29] Swan, J., et al. (1999). "Knowledge management and innovation: networks and networking." Journal of Knowledge Management 3(4): 262-275.