Models for Digital Storytelling and Interactive Narratives

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ABSTRACT

Digital storytelling represents a challenging way of creating a bridge between traditional oral storytelling and the form of communication adopted by modern media and information technology. In this paper I introduce a method for categorization of applications and outline a reference model in digital storytelling. The model will be useful for the analysis of existing, and the development of future applications. In this paper I present three showcases in Digital Storytelling and employ the reference model for analysis.

Keywords

Digital Storytelling, narrative, reference model, team awareness, edutainment, collaboration

1. INTRODUCTION

Digital Storytelling, Interactive Narratives - at a first glance it seems obvious what is to be understood by these terms. However, a closer look reveals a great variety of applications, which differ widely in the way they use, create or tell stories:

In Conversational Storytelling the user interacts with a virtual counterpart in a storytelling context [1, 2]. This approach combines non-verbal communication and discourse management with narrative structures and often employs mixed-reality user interfaces. Story structures find application in areas otherwise unrelated to storytelling. In Information Visualisation, story structures serve as a new form of interface metaphor. Digital storytelling serves as a means to structure and convey huge amounts of data, which otherwise would be difficult to understand and to process at one glance [3].

The advance of digital contents and the development of new types of user interfaces, e.g. in Virtual Reality and Mixed Reality, facilitates new ways of creating and experiencing stories. In these settings, stories emerge through interaction with the application, either on purpose, if the application targets at the creation of stories, or as a side-effect, e.g. in games where the focus is set on playing rather than on following a story. The area most commonly associated with digital storytelling is the field of dynamically generated stories. Storytelling applications in this category aim to entertain the user [4] or have an educational purpose [5]. They target at all age groups and use various types of user interfaces to enable user interaction with the story content.

Digital media material, stored in media repositories like digital photo archives, provides a source for a diversity of stories. The advance of digital photography, video and image processing techniques results in the creation of private media archives to share with friends. The stories inherent in media repositories are not visible at first glance but emerge by interacting with the media content. For example, browsing pictures with friends might result in a story about the people shown on the picture or on the occasion when the picture was taken. The advance of digital media allows a combination of several types of media, e.g. photography with other media types as sound or film.

These are, of course, no definite boundaries for the categories in storytelling. Applications might belong to several categories, depending on their emphasis and components. Each of the categories described provides its own definition of storytelling and its own set of parameters which categorize the application. But what defines a storytelling application in general? Which are the parameters required to categorize an application? Which factors are important for its success? Researchers have taken an overall view on the nature of storytelling[6] or have argued about differences, e.g. between games and storytelling[7, 8]. The discussion on the conflict between story coherence and user interactivity prevails in many publications[9, 10]. However, the question which guidelines to apply in the development of future storytelling applications still remains unresolved.

In this paper I will give an overview of the field of digital storytelling and its major application areas. I will outline and discuss parameters which appear of relevance for a wide range of digital storytelling applications, e.g. the structural degree of the story, the level of control and interactivity, the continuity of the plot, the possibilities for collaboration, the degree of virtuality and the cognitive effort for the user to create a coherent storyline. I will analyse three storytelling examples in order to develop a general model for digital storytelling which can be used as a framework useful for the future development of narrative applications. PhotoStory, StoryNet and DocuDrama, the three example applications presented in the following, relate to each other in their focus on dynamically generated stories, rely on user input but are generated without direct user interaction.

2. RELATED WORK

New media forms and especially Interactive Narratives have become a very popular subject of research. Several people have approached the topic from different angles. Especially the relation between games and narratives has raised much discussion. In the following section I intend to give an overview on different approaches to provide categories, classifications or conceptual frameworks on storytelling and related areas, such as games or collaborative virtual environments (CVE's).

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Fritz & Fehr have set their focus on games in an educational content. In [11], they present a catalogue of categories to be used for the analysis of edutainment applications. This catalogue combines general questions on the appearance and technical quality of the game with estimation of the quality of the gameplay, analysis of the game effect and dynamics, and an assessment of the pedagogical quality of the game. The catalogue of categories aims to provide a means of making detailed and comparable assessments of computer games. Stauber[12] employed these criteria to analyse a series of games with educational purpose.

Lindley also takes a look at the relationship between narratives and games. He analyses the temporal structure in games and narratives, presents a game/narrative model consisting of several layers and correlates each game level to a narrative level[13]. He describes the user interaction in games as Gameplay Gestalt, a unity of actions which combine perception, cognition and motor interaction. This is opposed to Narrative Gestalt, a pattern of actions, which enables the user to combine story elements into a coherent story.

Manninen examines interaction in collaborative virtual environments which, in his opinion, share many aspects with multiplayer computer games [14]. He describes and classifies different interaction forms in a scheme, e.g. Dramaturgical Interaction as the presentation of the user in a public environment, or Communicative Interaction for finding consensus between participants. The interaction form model aims to provide a conceptual framework for the analysis, evaluation and design of multiplayer games.

Mateas presents a character-based approach in extension of Aristotle's model of drama[15]. Using Aristotle's theory as a basis, he examines Laurel's definition of properties unique to dramatic stories, and discusses Murray's three categories relevant for the analysis of interactive storytelling applications. Laurel defines Enactment, Intensification and Unity of Action as properties of importance [16]. Murray proposes three categories for analysis: immersion, agency and transformation [6]. In his paper, Mateas presents a model based on Aristotle's theory, which has been extended by an interactive component on the level of characters. Façade, a storytelling application developed by Mateas and Stern [17], presents a system which builds upon this model.

Spierling et. al. [1] takes a closer look at the author of interactive storytelling applications. She presents an architecture with four hierarchical levels for authoring. The levels each provide a different degree of agency for the user in the development of the story. At each level the architecture consists of an engine and a corresponding model, e.g. story engine and story model. The engine is responsible for driving the action on that level, the model contains rules which defines this procedure.

In Rules of Play [18], Salen and Zimmerman offer a conceptual framework for game design. They view games from different perspectives, e.g. on Games as Narrative Play.

3. CATEGORIES

Depending on the definition of Digital Storytelling, there is a wide range of applications which belong to this research area. The variety of different storytelling applications is reflected in the variety of definitions of narrative and storytelling. Lindley states that "*In it's broadest sense, a narrative may be regarded as an experience in time that has some kind of feeling of unity and integrity*." [19]. Spierling et. al. states that *"Interactive story telling instead relies on a predefined story, a specific plot concerning facts and occurrences. Only the telling of the story is done interactively."* [1]. Salen and Zimmerman provide the reader with following definition *'A game is a narrative system in which the narrative experience of the player arises out of the functioning of the game as a whole'* [18] (p.419).

I define the term Digital Storytelling as valid for all types of applications which use digital media either to support, to enable the creation or to generate stories. The resulting stories might be told orally or presented with the use of digital means. Figure 1 presents storytelling categories along a vector. The position on the vector defines the degree of oral contribution to the storytelling process. For example, Media Repositories are positioned on the left side of the axis. They provide digital content and user interfaces which enable the creation of stories. The stories themselves are mostly told orally. Dynamically generated stories are positioned on the right side of the axis. They are based on digital content as well, but the story is presented digitally by the storytelling application. Zimmerman regards the terms games, play, narrative, and interactivity as "four concepts, each concept overlapping and intersecting the others in complex and unique ways" [20]. The storytelling categories presented above should similarly be regarded as concepts rather than categories with strong boundaries. Applications seldom belong exclusively to one category, but can be grouped according to their emphasis in storytelling.

Figure 1: A vector of storytelling categories

4. DIMENSIONS

The previous section gave an overview of the wide range of storytelling applications. However, all storytelling applications have factors in common. Digital stories are based on some type of story material. This can be abstract data but also a complete story written in prose. Stories usually follow a conceptual structure, which depends on the consistence of the material they are built upon. The degree of conceptual structure shows consequences in the story's coherence and continuity in the flow of the story. It also affects the cognitive effort required in order to create a mental version of the story. The presentation of digital stories varies according to their degree of spatiality and virtuality. Spatiality defines in how far objects in space, space itself and navigation are of relevance in the evolvement of the story. Virtuality defines the degree of involvement of a virtual environment in the story development. Also of interest is the degree of collaboration between users as part of the story experience, the degree of control the users have over the flow of events, and the level of interactivity the application allows. Finally, immersion and suspension of disbelief are factors which reflect how digital stories appeal to the user.

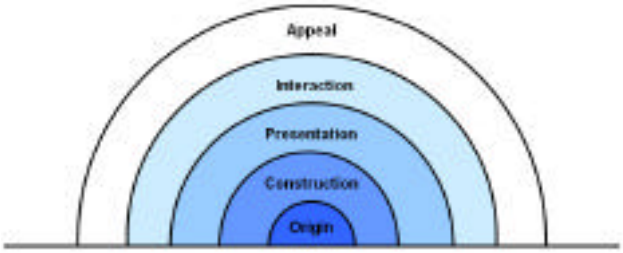

Figure 2: Layers

The dimensions mentioned above can be grouped in five different layers. Figure 2 gives an overview. The innermost layer comprises dimensions which apply to the story material. A layer on story construction forms the next level. On top of that follows a layer which examines the way the story is presented. The outermost layer comprises dimensions which examine the effect the application has on the user. The following section details the different layers and their dimensions.

The dimensions star, see Figure 3, displays all dimensions at one glance in the form of a star. Each axis of the star represents one dimension. The dimension star is a reference model for the analysis of three different applications in digital storytelling.

5. SHOWCASES

5.1 DocuDrama

DocuDrama forms a part of the project Theatre Of Work Enabling Relationships (TOWER). The idea of the TOWER project was to offer to members of a virtual team a platform which would make social encounters possible and provide team awareness [21].

Awareness of the activities of other team members affects the quality of work and provides a positive feeling within a group. Virtual teams which do not work in the same location but at geographically different places usually do not have such a close relationship, since they very seldom meet in person. A variety of tools developed in TOWER offers the user the possibility to become aware of the activities of team members in the work context and to start communication. The TOWER tools provide synchronous awareness about team activities; DocuDrama as part of TOWER offers asynchronous awareness. DocuDrama Conversation employs the TOWER virtual environment as a stage for a replay of activities.

Figure 3: Dimensions Star

Events presented in DocuDrama result from user activities in a BSCW collaborative workspace[22], a team workspace which serves as platform for the collaborative work on project documents. User interactions on documents are stored in a log-file. This data provides the base material for DocuDrama replays.

DocuDrama [23] was developed in the form of three different approaches. The version presented and analysed here is DocuDrama Conversation, which was developed at Fraunhofer FIT. DocuDrama Conversation [24] tells stories about collaborative activities in a virtual workspace. The focus of DocuDrama Conversation is on interaction between users of the workspaces. The two other approaches in DocuDrama focus on the history of documents (DocuDrama Timetunnel) and the progress of a project in general (DocuDrama Project).

The virtual environment of DocuDrama Conversation presents the data-structures of the collaborative workspace in a symbolic form. Geometrical objects in form of coloured boxes present different directories. Sign posts which symbolize the name or topic of the workspace serve as landmark for orientation in the virtual environment. The objects which belong to the respective workspace are placed around the sign posts. Avatars moving around in the virtual environment represent the members of the virtual team using the workspace. The avatars perform symbolic actions depicting the activities of team members.

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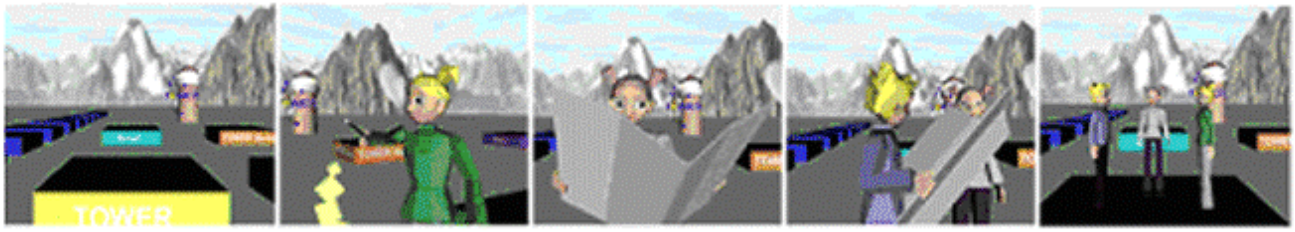

Figure 5: Dialog Scene with three actors

Figure 4 shows a scene in the virtual environment of DocuDrama Conversation The avatar in the front reading a newspaper presents a team member who has opened a document for reading. The avatar is placed on a coloured box which signifies that the document he just opened is a document located in this directory. The moving around between boxes represents a team member switching between directories.

Abstract user data stored in log-files provide the base for stories in DocuDrama Conversation. The challenge is to generate stories from this data, which attract the user's attention and to retrieve from the data information 'between the lines', e.g. the degree of collaboration on a project document.

DocuDrama Conversation allows the selection and sorting of events, e.g. by user, time span or type of event. The events are grouped together in a scene and played out by avatars performing symbolic actions. The avatars turn to each other while performing symbolic actions as they would in a conversation. The play-out of a summary of events on a single document and the presentation by avatars enable the user to quickly grasp the essential information about the work progress on a certain document. The film-like play out in DocuDrama Conversation also enables the user to understand coherences or to become aware of re-occurring patterns in team-members activities.

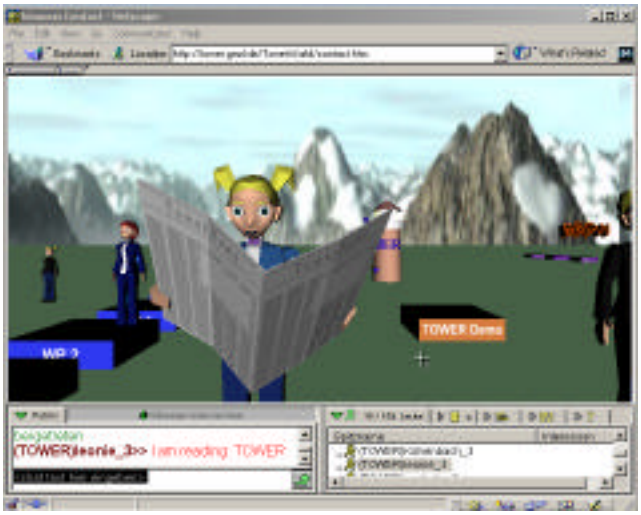

Figure 4: The DocuDrama Conversation virtual environment

Figure 5 shows a dialog scene with three actors in DocuDrama Conversation. Two avatars interact with each other as in a conversation; in turn they perform symbolic actions. In the scene shown above the first avatar shows a Create-Action. Two other avatars subsequently perform a Read-Action, which symbolizes the opening of a document for lecture. Dynamic camera navigation is employed to transfer the user to a central position in respect to the activities. It uses methods borrowed from film making to present the stories in a more exciting and attractive way [25].

Figure 6: Dimension Star for DocuDrama Conversation

The story material on which the DocuDramas are based is very abstract. In consequence the degree of *Concreteness* is very low. In DocuDrama conversation, the user takes the position of a spectator. He is not involved in the creation of the DocuDrama story content (*Involvement*). The analysis of DocuDrama Conversation shows a high degree of story *Coherence*. The story objects all show a relation to each other. The virtual environment is meaningful to the story through the positions of the avatars; all events which have occurred on a document are grouped together, and the symbolic actions performed are directly interrelated to each other. DocuDrama stories follow a clearly defined *Structure*, although they do not show the three-act-structure typical for dramatic narratives. A fair amount of *Cognitive Effort* is required to follow the story. The fact that there is a conversation taking place is easy to understand, but not necessarily the content of the interaction. DocuDrama stories take place in a virtual environment and use spatial metaphors to convey the story content (*Virtuality, Spatiality*). The user has little *Control* over the development of the story. He only can decide by selection about the composition of the story elements. The application shows a low degree on *Interactivity*. The user only has the option to stop or restart the story one it has been

started. DocuDrama Conversation was developed as a single user application without options for *Collaboration*. Owing to the conformity of the presentation the degree of *Immersion* is very low. Figure 6 shows the Dimension star for DocuDrama Conversation.

5.2 StoryNet

StoryNet provides a game-like approach to edutainment. The application targets at participants of seminars on social issues like conflict management or social competence [26].

The plot in StoryNet describes a conflict situation at the workplace. The story is presented to the user in first-person-view. The user takes the part of the main protagonist and is placed in a network of social relationships which typically exist at a workplace. The user has to define his personal goals which he will follow while the story proceeds. The user can revise his decisions at any time. The story does not offer a clear winning or loosing scenario; it is up to the user to judge on the result of his game session. Figure 7 shows scenes from StoryNet.

StoryNet is divided into two conceptual parts. Part one is structured like a tree; each fork requires a decision of the user. The user decides on the progress of the story by emotions, i.e. by control of a set of sliders. In each scene, for each interaction with a story protagonist, the user collects points on conflict and harmony. This way a personal user profile on his relationship with other story characters is developed. The second part of StoryNet shows the result of the user's behaviour. It consists of a collection of scenes which are organized in different levels. At each level the user is provided with a scene which shows the state of the user's relationship to one of the protagonists. The scenes which are presented to the user are selected based on the user's total on conflict and harmony points which he has collected in the first phase of StoryNet. For example, a user behaving moodily and unfriendly in the first part of StoryNet is very likely to receive an unfriendly reaction from the story protagonists in the second phase. If the user shows diplomatic skill in interacting with the story's protagonists in part one, he will probably receive a friendly and welcoming feedback in StoryNet part two.

The first part of StoryNet follows a hierarchical treelike structure. Samsel & Wimberly define this form of plot structure as Bottlenecking [27]. The story starts with a pre-defined sequence of scenes, and ends with a pre-defined scene. In between, on each level the user has several choices on how to proceed. However, since the user interacts by definition of emotions and not by selecting single scenes, the actual story tree remains in the background hidden from the user.

In the second part, scenes are grouped at different levels. This version of plot structure can be labeled Parallel Streaming [27]. Each scene is assigned a number of points on conflict on harmony. The scene which shows the closest match to the user's number of points is selected for display. In part two, the user has the role of a spectator. The story proceeds like a film, no user interaction is required.

Figure 7. Scenes from StoryNet

Figure 8: Dimension Star for StoryNet

StoryNet is still in the process of development. Pre-user tests which have been conducted on a demo version of StoryNet showed a high interest in the topic. The users enjoyed interacting with StoryNet, and provided ideas for future work, e.g. the development of an overview of the user's current position in the story tree, and a display of the totals of points on conflict and harmony at the end of the first phase.

Figure 8 shows the Dimension Star resulting from the analysis of StoryNet. The story material in StoryNet is very *concrete*; it consists of predefined scenes with images, text and a selection of sliders. The user experiences the story from a first-person-view. He takes the role of the main protagonist in StoryNet. His decisions influence directly the resulting story. The dimension *Involvement* therefore is rated high. StoryNet has been developed as a *coherent* story which can be experienced from different perspectives. For the user it evolves while interacting with the system, but the storyline itself does not evolve. In consequence, the dimension *Continuity* receives a low value. StoryNet has a three act *structure* and this way follows the model of a dramatic narrative. The story is presented similar to a cartoon and therefore easy to follow (*Cognitive Effort*). *Virtuality* and *Spatiality* are both rated low, since StoryNet is a 2D application. Navigation in virtual space or virtual environments in general do not apply. The user can influence the progress of the story by emotion but has no direct *Control* over the next scene presented. StoryNet was developed as single user application for personal training in addition to seminars. There is no option for *Collaboration* with other users. In the first

session on StoryNet users got very immersed in the story. The degree of *Immersion* declined in further sessions and is subject of improvement in future versions of StoryNet.

5.3 PhotoStory

PhotoStory [28] still is in its concept phase, nevertheless I think the concept of PhotoStory qualifies for an analysis with respect to storytelling, since the analysis does not focus on implementation details but on features inherent to the PhotoStory concept. PhotoStory aims to provide a collaborative platform for the creation and exchange of stories. Possible applications are the use as a tool for the learning of languages and to support cultural understanding, to provide awareness about team activities, and to offer a means to present a virtual group to the outside world. The intention of creating stories with PhotoStory is twofold. The first intention is to enable communication across borders and to overcome the language barrier. The second intention is more playful. It aims at the random creation of stories based on material available in the media database.

The approach was tested with a group of girls at an open house event at FIT. The girls, aged 8-14, were given of developing a story. First they had to agree on a story subject. The next step was to develop a storyline, taking into account a dramatic arc. The girls then took digital photographs for the story. The pictures were uploaded in a PhotoStory workspace and annotated with keywords. The keywords described the content of the images, author, date, and name of the story. Additionally it was possible to check keywords which described the position of the image within the dramatic arc of the story. The next step in Photostory, though not evaluated yet, will be the retrieval of pictures and their re-arrangement in form of stories. Two options are possible. The first option will allow the retrieval of images for a story by keywords, in the consistence and sequence intended by the author. The second option will allow a random generation of stories, also based on keywords but this time taking into account the keywords' match with the dramatic arc.

Figure 9: An example for a PhotoStory

The dramatic arc, as defined by Frevtag [29], starts with an introduction to the situation, i.e. the location and the people. The arc rises and with it the tension – will the actors succeed or fail? The top of the arc presents the solution to this question. Then the arc descends again with declining tension towards the end of the story, e.g. the happy end.

Figure 9 shows an example for a PhotoStory. It tells the story of a girl which goes for skiing. It is only a short story but follows with its structure a dramatic story arc. The first picture gives an introduction to the location and the actors, the second picture explains the action, the third picture shows the climax – the girl racing on her skis - and the final picture presents the resolution – the girl successfully arriving at the goal.

Figure 10: Dimension Star for PhotoStory

PhotoStory uses non-abstract media material which is provided by the users (*Concreteness*). The story results from interaction with the system. The user as story author is responsible for the creation of a story. The user as audience is responsible for the input of keywords which allow the compilation of a story, either re-compiled as intended by the author or consisting of randomly selected media material. The dimension *Involvement* therefore receives a high value. The objects of the story as media objects in a database do not provide any *Coherence* between each other. Furthermore, there is no storyline existent in the background which evolves over time (*Continuity*). However, the degree of *Structure* is very high since the user as author is supposed to create stories which follow the dramatic story arc. The stories generated randomly for the user follow this rule. Regarding the randomly generated stories the *Cognitive Effort* can be very high. *Virtuality* plays a major role, since both the creation and the presentation of the story take place in a virtual collaborative workspace. *Spatiality* does not apply since the media material consists exclusively of images and text. The user as author has a high degree of control on the story content, but as audience he exerts only a low degree of control. This results in a medium rating for the dimension *Control*. PhotoStory offers several possibilities for interaction (*Interactivity*). It is a highly collaborative application (*Collaboration*). *Immersion* is ranked rather low, also comparable to a cartoon rather than a

highly immersive book. Figure 10 shows the dimension star resulting from the analysis of PhotoStory.

6. DISCUSSION AND CONCLUSION

In this paper I presented an overview of the wide range of applications in Digital Storytelling. I provided a classification which groups applications in different categories in respect to their degree on oral vs. digital storytelling. I introduced the Dimension Star as a reference model and analysed three storytelling applications with different foci and features. The Dimension Star can be used for analyzing applications in digital storytelling, and will also serve as a design guideline for the development of future systems.

The Dimension Star enables the user to see at a glance the strengths and weaknesses of an application. It allows comparison between different applications in respect to its dimensions. The Dimension Star as a reference model simplifies the classifying and assigning of applications to a category.

It might be argued whether a classification in categories is a useful approach for any type of system. Especially if systems show qualities and features which might belong to several of the presented categories. However, in the first stages of conceptualization, design and development of a storytelling system, such a categorization will provide valuable support. The different dimensions allow are to compare and benchmark developments against successful applications which are representative for the respective category.

Future Work will include a refinement in the definition of the dimensions. It will also include the extension of the Dimension Star for further dimensions to enable comparison and benchmarking in more detail. Furthermore the reference model will be verified by applying it to a wider variety of applications, e.g. games, film or even non-storytelling applications. This will provide the user with a better understanding of the applicability of the Dimension Star as a reference model. The future and long-term goal will be to develop general design guidelines for applications in Digital Storytelling.

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