Learn your own way: decision way through narrative approaches, methods and paradigms for learning purposes

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Abstract

This paper gives reasons for the chosen Digital Storytelling approach for Non-Linear Extended Blended Learning. Hence, umpteen levels of Digital Storytelling are looked at from different point of view. Thus, important background information is given. The result is a well-grounded decision for the principles of the aimed coherence engine that will be the realisation of these concepts. Finally, further steps for finalising and integrating an usable engine are addressed.

Keywords

eLearning, Blended Learning, Digital Storytelling, User-Adaptation, Interaction

1. Introduction

Extended Blended Learning is the successor of Blended Learning. Its approach of integrating face to face learning, eLearning and project based learning is a promising solution to overcome the obstacles of earlier (pure) eLearning attempts (Bleimann and Röll, 2006).

Atlantis University is the first learning project that realises the principles of Extended Blended Learning (Bleimann, 2004). Because of its narrative structures, storytelling is a possible for a better way of learning (Niegemann *et al.* 2004, p30), and an approach for author-friendly handling of complex interactive content (Schneider, 2002). One main reason for this is, that humans live with stories from their beginning:

"Narrative is present in every age, in every place, in every society; it begins with the very history of mankind and there nowhere is nor has been a people without narrative." (Barthes, 1996)

Hence, it had been decided to implement a Digital Storytelling based coherence engine for the Atlantis University project (Schneider *et al.* 2006). This paper shows the decision way to the chosen Digital Storytelling approach.

2. Motivation

Dan Norman states: "For teaching to be effective, cognition an emotion must work together." (Currin, 2004) This statement gets confirmed by studies in neuronal sciences that aver the importance of emotional engagement for learning efforts and motivation (Spitzer, 2002). The key for this can be found in stories: Stories foster emotional engagement, because of having content structured in a suspenseful way. Total immersion of in the imaginary world can be caused for the recipient, because of experiencing a good story.

Stories and their structures provide essential functionalities for learning environments: Focussing the teacher's attention, provision of information and feedback about the learner's efforts (Gagné *et al.* 1992). Stories are not limited to a certain topic. With narrative structures complex dependencies can be explained in a human understandable way. Stories are fundamental to culture and human understanding. They have familiar structures, which are recognisable and can easily be understood. In human tradition stories were means for information transmission and knowledge acquisition, e.g. within families and cultural communities. "Much true understanding is achieved through storytelling. Stories are how we communicate events and thought processes." (Schell, 2002)

This can be summarised as: The pedagogical dimensions of stories span are humanistic, cross disciplinary, cross-cultural, multy-sensory, multi-modal, constructivist and learning directed (Springer et al., 2004).

3. Decision Way

To find the right approach for integrating Digital Storytelling concepts in Atlantis University, this papers looks from different point of views onto this field of research. Therefore, it starts with a survey of the most important story models – concerning their relevance to Digital Storytelling. This gives an overview of general storytelling methods and the relating narrative principles. To get deeper into the subject, a technical view onto the different technical approaches of Digital Storytelling follows. Last, existing Digital Storytelling projects are benchmarked regarding their utility for Extended Blended Learning.

The specific requirements for a Digital Storytelling based coherence engine – thus, for all underlying approaches, methods and paradigms – are as follows: For the Atlantis University project a storyteller for presenting the content is needed, but not a story writer. The focus of the research is on when and which content is presented, but it's not about how. Thus, the realised coherence engine has to organise content on the basis of the users' interaction and his previous history, but there's no need of anthropomorphic mimic presentation. Human authors should do the creation and annotation of the content.

3.1. Modern story Models

In general a story integrates structure, content, context and its progression as a unit (Linane-Mallon and Webb, 1997). During the narrative spatial relations between are originated characters, properties and objects (Herman, 1999). Narratives themselves can be categorised into discourse and story (Chatman, 1978), whereas the story represents the narrative and the discourse is responsible for the presentation (Meech, 1999). Only the relevant information is presented in a story (Boella et al., 1999), because it otherwise would become boring (Sengers, 2000).

Because these general explanations are not very helpful for the realisation of an engine, more detailed models are looked at in the following.

3.1.1. Syd Field Paradigm

Syd Field's paradigm (Field, 1992) is considered as the basic structure of the Hollywood cinema. It is geared to the mythical heroic stories, that is described by Campbell as follows (Campbell, 1999,p13):

"The hero leaves the world of the common day and visits an area of supernatural miracles, passes there fable-like powers and gains a determining victory, then he returns with the strength to stock his person with blessings, from his secret-full journey."

Like Aristotle, Syd Field divides a story into three acts: Exposition, confrontation and resolution, whereas the narrative should emerge permanently – at least every 10 to 15 minutes something signicant should happen in the motion picture.

The leading character is introduced in the exposition. It is explained what the story is about and what is the dramatic situation. This notion of the basic structure and point of departure of the story should last approximately 25 minutes. After this, the first plot point follows. This is a turn, that wakes a need which must be satisfied. In the second act the hero starts his search for the fulfilment of his needs. Hence, because of obstacles suspense and action arises respectively. These obstacles culminate into the second plot point – the climax – that pushes the story into the third act to the resolution.

A film has several plots to Field. However, the two plot points at the end of the first both acts are the most important ones, because these propel the narrative forward and explain the further progression. Only after the first plot point the hero has the motivation to accomplish something and to look for the confrontation. And only after the second plot point all obstacles are overcome, thus his way is free to achieve his purpose that leads to the resolution of the story.

It is interesting that Field applies the second plot Point with approximately 85 to 90 minutes. Because this corresponds to the length of most Hollywood films, it can be derived, that the confrontation is the main element of a story according to Syd Field and implies therefore the emotional immersion with the viewer. The resolution of the

story is important to achieve a unity and a consistency of the story, however, it doesn't bear a film and it is in an unequal relation to the first and second act. Good stories arise from misfortune, but not because of luck, like it is said in journalistic circles: "Only bad news are good news" (Wilder, 1951).

3.1.2. The Propp Model

The Russian formalist Wladimir Jakowlewitsch Propp established a model for the structural analysis of Russian fairytales (Propp,1958). He concluded, that all Russian fairy tales show the same structure irrespective of the mode of content. A story is divided into individual functions, which act on the course of the story. This is irrespective of the concrete action that happens within a function and the person that carries it out.

Propp calls them morphological functions. The functions' impact onto the course of the story are unalterable, however, the content itself may differ. Their figure is changeable and therefore "morphologically". These functions are constant basic units of the story. Their quantity is limited and they are always in the same order. However, not all functions need to happen during a concrete story (Grasbon, 2001).

Propp introduced a system for the notation of this structure of the fairy tales, while he assigned a symbol to each function. Basically he distinguishes two categories of stories: On the one hand defeating an enemy in a fight (1), on the other hand, solving a difficult assignment (2). The structures of both stories look as follows:

```
A B C ↑ D E F G   H     J I   K ↓ Pr Rs ° L Q Ex T U W * (1)
A B C ↑ D E F G ° L M J   N K ↓ Pr Rs °   Q Ex T U W * (2)
```

Some functions may be left out, however, there are some dependencies. For example, the misfortune `A` must be made good in `K`. A fight against the enemy `H` leads necessarily to the victory `I`, a difficult assignment `M` for their coping `N` and the pursuit of the hero `Pr` to his rescue `Rs` (Grasbon, 2001, p64). This can be noted as follows:

```
A  → K
H  → I
M  → N
Pr → Rs
```

3.1.3. 20 Masterplots

Ronald B. Tobias has described twenty returning narrative structures which he refers as *20 master plots* (Tobias, 1999). However, the choice and the underlying reason seems questionable. For instance, the reason for the classification of the plots *rivalry* and *love* is the relation between the central characters. However, the source motive is decisive with *search* and *escape*.

Already in 1928 a similar approach has been criticised by Vladimir Propp for same reasons (Propp, 1958,p7). Even Tobias grants that an action can fall back on several

categories, thus, the plots are combinable with each other. However, an action thread has to remain recognisably as a main plot (Tobias, 1999,pp 317).

3.1.4. Barthes' Model

Barthes proposes to study narratives on different levels of description (Barthes, 1996). He describes three levels of instances: functions, actions, and narration.

```
narration (top level)
  narrative communication
  narrative situation

actions (middle level)

functions (bottom level)
  functions (relate to the same level)
    cardinal functions (nuclei) (important for the narrative)
    catalysers (complementary)
  indices (relate across levels)
    indices (relate to character, feeling, atmosphere, philosophy)
    informants (identifies, locates in space and time)
```

Functions are the smallest unit of narrative, something that may not have meaning directly but which acquire meaning in combination with other units, on the same level or on a higher level. Functions can in some cases be shorter than the sentence, even parts of a word.

Actions is the level of characters. Characters in the narrative are classified according to their participation in actions. Actions often have two sides. For instance *Giving* has a Donor and a Receiver. Examples of actions are desire, communication, struggle.

The narrational level includes narrative communication between author, narrator and recipient and narrative situation as a set of protocols according to which the narrative is consumed. Here is included different styles of representation, the point of view and codalities.

3.1.5. Appraisal

At first, Vladimir Propp's model was intended only to formally describe Russian fairy tales. The Russian formalism is certainly an especially extreme approach to dispose of all aesthetic aspects of a story. Nevertheless, this approach is not new – Aristoteles already divided the drama into the three elements prologue, episode and exodos (Komerell,1988, p9).

Because of its huge quantity of functions and its very precise formulation, Propp's model seems to be very restrictive and less applicable in contrast to Syd Field's paradigm. However, there are a lot of parallels: Both see a misfortune at the beginning of the story (that is needed to begin the story). Syd Field defines this misfortune as the first plot point. Before this, the first act describes the pre-story. Propp's model says the same: The first act is equivalent to the function alpha, the first plot point is defined as `A`, the misfortune. According to Syd Field the hero undertakes everything to end the misfortune in the second act. After a huge number

of adventures the second act accumulates to a climax (the second plot Point) in which the misfortune is finished. Propp's paradigm is correspondent, the hero starts to finish the misfortune after an amount of adventures experiences (function C), and stops, in the end, the misfortune in K. Hence, all points of the Syd Field paradigm are defined by Propp's model.

Compared with Vladimir Propp's classification Tobias' 20 master plots falls back clearly. This inherently applies for linear stories, for computer based non-linear stories Tobias' model may just serve as a provider of additional ideas. With the application of one of his 20 master plots the scenario decreases to one story with the very chosen plot – a linear story would result, that prevents every interactive impact on the events. In contrast, Propp's model merges all variations in one single model and at every time of the story alternatives for other courses through the storyline are available.

Barthes' approach is of interest for the overall system and corresponds to a large extend with the hierarchical approach – see section 3.2.5) (Aylett, 1999). However, for one single engine it seems be too complex.

3.2. Technical Approaches to Digital Storytelling

1990 the research topic *Narrative Intelligence* has been established at the MIT by the *Narrative Intelligence Reading Group* (Davis and Travers, 2002). It has been discussed how people organise her experiences in the form of stories – as a central issue of the Narrative Intelligence (Mateas and Sengers, 1999). To give consideration to this complicated and interdisciplinary question, the discussion group has been based on knowledge of the areas artificial intelligence, literature, human computer interaction, philosophy, media theory, psychology and cognitive science.

The approaches to the automation of the linear narrative are also of interest to Interactive Storytelling. These can be differentiated in three categories (Bailey, 1999): Author-based systems try to model the human author tasks, stories-based systems use abstract descriptions like a story grammar (Lang, 1999) and world-based systems create a world with autonomous characters.

Strictly speaking there are no interactive stories, because stories hold a complete structure that can't be changed any more (Crawford, 2000, p240). However, the *presentation* of a story may be interactive.

Especially the effect on the audience is of particular importance for Interactive Digital Storytelling (Mateas and Sengers, 1999). It is a matter of presenting to the recipients an interesting and exciting story, but not about modelling of the author's or the audience's tasks. The following attempts take into consideration the requirements of presenting interactive stories.

3.2.1. Character-Based Approach

This approach assumes, that exciting stories arise automatically by the interaction between the recipients and autonomous agents. Hence, the agents feature modules

for the perception, for a knowledge base, for their state as well as aim(s) and planning algorithms. Based on this, they make decisions independently (Russell and Norvig, 1995).

With these systems the stories originate by the moment of interaction. Hence, they are generative in the highest degree. The player has the greatest possible leverage on the course of the story. Such systems are also called *Emergent Narrative*.

3.2.2. Action-Based Approach

The basis of the action-based approaches lies in the abstraction of personal motivations, experiences and the destinations of the characters that are involved in the action (Propp, 1958). The actions of the persons are motivated less by their own interests, but even more by the narrator's interests. Therefore the action might (and should) contradict the characters interests.

3.2.3. Rule-Based Approach

The rule-based approach tries to formalise dramatic structures and to conceptualise them in rules. Concrete actions are generated by a given set of rules.

However, it seems very unlikely that the creative and artistic essence of a drama can be reduced to a set of machine-understandable rules (Bringsjord and Ferrucci, 1999). If the story exists out of known parts and an author has rated these, a set of rules may be used for the presentation (Crawford, 1999).

3.2.4. World-Based Approach

World-based approaches combine Emergent Narrative with simulation – and exactly this raises a problem: A simulation is such complex that it requires the description of needlessly many details. Thus, the concentration on the essential dramaturgical elements is hindered (Braun, 2003, p63).

3.2.5. Hierarchical Approach

Hierarchical approaches tries to avoid the established disadvantages by the combination of the existing attempts. They introduce four abstraction levels (Aylett, 1999): The superior action (e.g., Propp's functions), the action sequences at character level for the different action variations of the particular functions, as well as the cognitive and the reactively physical behaviour.

Because of this partitioning this approach is extremely adaptable. The more levels are not influenced by the author, the more autonomous the overall system is. A consideration of both possible extreme cases shows this impressively: If the author gives every level, a linear story results. If, however, every level can freely improvise, the story is constructed completely at run time – it concerns Emergent Narrative.

3.2.6. Appraisal

Unfortunately, the character-based approaches don not have any knowledge about exciting and presentation-worth actions. Completely dull details are told in full length. It is very difficult to achieve coherence of the action and suspense.

Rule-based approaches retire because of their difficult or even impossible implementation. Even if a realisation would be possible, the author-unfriendly abstraction might complicate the usability needlessly.

Not being author-friendly excludes the world-based approaches, too. Beside the disadvantages of the character-based approaches, the vast amounts of details to be described are an additional obstacle.

The concepts of the present engine are based on the action-based attempts, because action is pushing the achievement of suspense (Field, 1992). However, the overall system should correspond to the hierarchical approach in which the coherence engine is embedded.

3.3. Storytelling Projects

Often computer games are regarded as interactive stories. The following distinguishing features can be made (Murray, 1998, p140):

- Games provide *one* form of activity.
- Games often require learning a skill.
- Games use language instrumentally without describing nuances of emotions.
- Games contain a diminished and schematised worldview.
- Games are organised in moves and destination-based.

Especially adventure games are treated as equal with Digitally Storytelling or Interactive Fiction. Nevertheless, the main attention of adventure games are solving of riddles, while Digital Storytelling requires a storyline as well as a characterisation of the characters (Goetz, 1994). However, both are developed too briefly in adventure games (Crawford, 2000, p240): The immediate connection between the background story and the actions of the player doesn't exist, the players' actions are only rudimentary expressed in the body language of their characters, and the players don't implicate other characters of the story (Aylett, 1999). In addition, the player cannot fully unfold his abilities for linguistic communication and social interaction (Aarseth, 1997)

Shooter games point out action, animation, spatial thinking, resource management and special effects, however, neglect action and characters (Crawford, 2000, p240). Immediate physical behaviour exceeding action sequences are missing. The ability of saving scores is absolutely problematic, because coming back to the point that has been left before may degrade the coherence of the story (Aylett, 1999).

3.3.1. Oz

The research project Oz of the Carnegie Mellon University (Bates, 1992) is a typical representative for Emergent Narrative and, has performed pioneering work for the research of the interactive drama (Mateas, 1999). The project has concentrated upon the development of believable agents to let interoperate them with the players as authentic characters. Hence, a suspenseful story should be created autonomously.

Because this assumption has not been confirmed, a concept for a drama manager has been developed (Mateas and Stern, 2000). Unfortunately, this has never been implemented completely (Weyhrauch, 1997). The concept consisted in determining a choice and sequence of plot points with the introduction of corresponding transitional scenes by unidirectional brief commands that should advance the storyline. The drama manager should intervene in the course of the story only every now and then, otherwise the agents should remain widely autonomous.

An additional stage manager should take over the control of the storyline. At last this has admitted no autonomy of the agents any more, any independent action mechanisms had to be avoided.

3.3.2. Erasmatron

In this world-based project a microeconomic model allows the characters to palter among each other. The lowest abstraction level provides the realistic behaviour of the characters, as the movement of the characters on the right stage. The purposeful behaviour of the characters is predefined by a clause-based approach.

As in natural languages, a clause exists of subject, property, verb and other elements like indirect and prepositional properties as well as adverbial clauses and subordinate clauses. Characters may adopt the role from subjects as well as from properties. As a basis component of the operation, verbs express actions. The author defines corresponding roles for every verb. The actors as a subject or property adopt these roles. For instance, `hide` may be associated with the role of the pursuer. For each role dramaturgical sensible reactions are defined by verbs. Following behaviours have been implemented in Erasmatron: Reactions, planning, plan performing by the characters, lies, sniffing out secrets, deferment of deliberate action because of observation of wrong persons as well as anticipation of likely reactions to a action taken into consideration. However, the system is not laid out on a superior timing. This happens indirectly by the verb `PlotPoint`, however, the system is unfitted to this purpose.

Erasmatron is one of few projects that bear up against an implementing. However, the problem is the complexity of the production of a story for the system, so up to now no author had been able to implement a story world (Crawford, 1999).

3.3.3. DEFACTO

DEFACTO adopts the Aristotle's concept of conflict and resolution with a rule-based system (Sgouros, 1999). The characters come in conflict with each other while tuning in to their aims (Sgouros, 2000). These conflicts are increased up to the climax in which the decision on the denouement of the story is made and all conflicts are resolved successively. The most dramatically effective possibilities are chosen out of all available actions. The player adopts a role and is involved into the action very often.

DEFACTO consists of a story engine, a module for natural-speaking output and a multimedia interface. However, no published results are to be found and the demonstrator (DEFACTO, 2006) is too smallish to be meaningful.

3.3.4. Façade

The *Interactive Storyworld* Façade is a simulation including a drama manager. It integrates interaction at story level (drama management), believable agents and an uncomplex natural language processing in the context of a graphic interactive first-person drama on a real-time basis. The discourse is not turn-based, but continuously and real time.

Façade is based on so-called *beats* as a basis for interaction and plot – they propel, so to speak, like a heartbeat the story. The beats are a collection of behaviour, linked with a certain situation or a certain context. Beats are annotated by the author with preconditions and their impact on the history. The player has in turn impact on the outcome of generally held beats and can influence thus the course of the storyline.

For the production of interactive stories four authoring languages have been developed:

- A Behaviour Language (ABL):
  A reactive planning language
- Natural Language Understanding (NLU):
  On pattern matching based template language for the language input.
- Reaction Decider Language:
  Selects reactions from discourses and suggests reactions.
- Beat Sequencing Language:
  Language specialised on drama management.

Façade is one of the few and far realisations of an Interactive Storytelling environment that has been implemented completely and for that at least one interactive history has been realised. With a free downloadable demonstrator (Mateas and Stern, 2006) this can be evaluated by everyone.

3.3.5. IDtension

IDtension consists out of the following central components (Szilas, 2003): The *World of Story* to manage the basic elements and their states, the *Narrative Logic* computes all possible operations of the characters, *Narrative Sequencer* selects the operations with the most interesting narrative effect, the *user model* regulates the state of the user and his impact on the story, finally, the *Theatre* shows the story. While the system IDtension itself is very promising, it also has to fight with the usability for authors: The production of stories happens very abstractly and does not correspond therefore to the creative process authors are used to (Szilas *et al.* 2003).

3.3.6. alVRed

alVRed is, actually, an authoring environment for "Non-Linear Dramaturgy in Virtual Reality" environments (Wages and Grützmacher, 2004). It offers a lot of interesting modules for authors for the production and presentation of non-linear content with narrative metaphors. However, the major disadvantage of the used story engine is that it is based on branching. Because, however, many other portions for interactively visual presentations have been realised, it may be used in the presentation level including the first processing of user's operations.

3.3.7. StoryEngine

The primality Propp model based StoryEngine had been realised by Norbert Braun and Dieter Grasbon at the Zentrum für Graphische Datenverarbeitung e.V. (Computer Graphics Centre) in Darmstadt, Germany (Grasbon and Braun, 2001). Basically the StoryEngine has knowledge about the story model and the dependence between the morphological functions introduced by Propp. The author has to fill a database with a huge number of scenes. A function must be assigned to each of these scenes. Depending on context, the scene and the playtime the story engine chooses an appropriate scene out of the functions. The context indicates which variables are important for this scene or for the storyline. There are six characteristics for the context:

- Actor: Only dramatic persons in the context appear. Fifty persons on the stage can stay, speak, trade and interoperate with the player. As long as they are no dramatic person, they are not described.
- Magical Assistant: The Magical Assistant can have different occurrences. It is important that the Magical Assistant helps the hero to defeat the enemy and to undo the misfortune later.
- Misfortune: The misfortune the initiates the story.
- Background: The background knowledge. The events which have happened or occurrences which has to be reminded -- knowledge of the general public.
- Sign: Hints to occurrences, thus the hero's knowledge.
- Risk: The risk that a misfortune happens.

Each of these six context kinds has three characteristics: The context can be anew in the story, it is required in the scene or it disappears from the story. Hence, scenes can be described at an abstract level, and the StoryEngine can generate thus stories according to the Propp model, without inconsistencies appear. Furthermore the StoryEngine attends that scenes are played properly at the current place and that the overall playtime complies with the pre-setting.

3.3.8. Appraisal

Most of the projects introduced here try either to leave the generation of the story to the computer (Oz, Erasmatron, DEFACTO and IDtension), or they fall back on the branching approach (alVRed) which is not suited for the production of contents with bigger complexity. Façade uses another approach, which leaves the regulation of the progression at several levels sometimes more to the author, sometimes to the engines in co-operation with the user's interactions.

The implementation of the coherence engine for Atlantis University will be based on the StoryEngine. This is, because the underlying Propp Model fits best the project's needs of modelling and organising the (pre-) authored content. The action-based approach is realised using contexts as the coherence parameter. The flexibility of its structures enables the creation of stories that are completely linear, non-linear with the guaranty of coherence up to random content presentation. Hence, this gives the authors the possibility of creating a linear content at the beginning and de-linear it step by step (Schneider *et al.* 2003). The content-model based structuring enables mixing of related content of different authors and the adaptive presentation to fit the different learner types.

4. Conclusion and Future Work

The decision way presented in this paper results in using the StoryEngine as a basis for implementing non-linear Extended Blended Learning. Beside its appropriate methodical and technical background it has already shown that it's applicable for edutainment purposes in various projects (Göbel *et al.* 2003).

However, the existing StoryEngine can't be adopted as is. First of all, the original StoryEngine is confined to Propp's model. Of course, the Atlantis University project needs the flexibility to build pedagogical based models. Second, its architecture has to fit into the SOA-based Atlantis University environment. Furthermore, it has to be robust for long-term usage, because it may be intended to plan whole courses.

The prototypical implementation of the “Coherentor” named coherence engine is nearly finished. After some technical tests the engine will be evaluated with pedagogical models as Anchored Instruction (Bransford *et al.* 1990), Cognitive Apprenticeship (Brown *et al.* 1989), Goal Based Scenarios (Schank, 1995) or 4C/ID (van Merriënboer and Kester, 2005). Therefore, models will be realised in co-operation with pedagogues.

Additionally, further integration for real live usage has to be done. And, of course, an authoring environment has to be developed, because a presentation without content is useless. At least, an evaluation of the environment with students within a real lecture scenario is planned.

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