Non-Linear Extended Blended Learning

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Abstract

The *extended blended learning* approach combines three different types of learning and teaching: face-to-face learning, e-learning and project based learning. This conceptual position paper discusses techniques for a new content-coherent, non-linear interactive extension to the existing e-learning part of extended blended learning including an authoring environment. Based on Digital Storytelling concepts, this extension will enable adaptive e-learning, increase collaboration and integrate the different types of learning and teaching. Additionally, Interactive Storytelling authoring concepts facilitates the creation of Units of Learning for authors, who are not used to the creation of non-linear content.

Keywords

e-Learning, Blended Learning, Digital Storytelling, Authoring, User-Adaptation, Interaction

1 Introduction

Extended blended learning (Bleimann and Röll, 2006) is an attempt to address the growing demands of modern learning environments. In order to optimise integration of learners, lecturers and the learning-environment, this concept adds project-based learning to blended learning, that comprehends face-to-face learning and e-learning.

1.1 Usage of the Term "Non-Linearity"

Within this paper, "non-linearity" is used to distinguish between linear and non-linear content presentation. This paper is not about "non-linearity" as it is used in the mathematical-context.

Nowadays, everybody is used to linear forms of presentations, in most cases books, motion-pictures and radio-plays are all linear media. Even though some stories are non-linear (for example Pulp Fiction), the presentation itself is linear – from the beginning of the motion-piture to its end. Hyperlinked-stories or computer-games are typical examples for non-linearity – by stepping in the user influences the progression.

Within this context, non-linear presentation means neither action-driven learning nor that learners even take notice of non-linearity. It's more comparable to a lecture or, as another example, parents narrating a fairy-tale to their children: there is only one Cinderella, but it has been told

in many different ways. Sometimes it is presented as short story, because the children are tired and the narration has to come to its end fast, whereas at other times the children are curious and ask questions, so parts of the fairy-tale are told with greater depth, or the narration sequence is changed.

In the digital world content-presentation's progression is changed at decision points. But from the user's point of view there is a major disadvantage in non-linear presentations: He might think that he has missed something and becomes unsatisfied (Ryan, 2001). Hence, mostly there is a need to hide decision points (Mateas and Stern, 2000). Therefore, taking care of content's coherence is the most important aspect. In addition, most decisions have to be implicitly carried out.

1.2 Benefits of Non-Linear Extended Blended Learning

There are several benefits in applying the principle of non-linearty to extended blended learning. Firstly, non-linearity enables the creation of adaptive learning environments, enabling the accomodation of the different learning styles of students. While some learners are comfortable with streaming text, while other learners need illustrations for understanding. Some learners prefer practical examples before learning the theoretical background, while other learners need to learn the theory before they may understand the practical examples. Tests have shown that adaptation and personalisation may increase learning performances. For example, using suggestopedical practices practices could nearly double the performance of learners in tests (französisch intensiv seminar, 2003).

Non-linear extended blended learning enables the personalisation of instructions in respect to the learner type. This might be accomplished by exchanging the course's content (for example, authored by another lecturer), by changing the way of content presentation (for example, text, illustrations or film), by adapting the environment as possible interactions, or by diversifying the order of the Units of Learning.

With non-linearity the inclusion of explicit interactive Units of Learning is possible. This includes practical experiments and assessments. Furthermore, their results may influence the ongoing course's direction. In an advanced level of development, students may ask questions that might be answered context-based by the system.

Collaboration may be encouraged by the redirection of questions to other students. The student with the best fitting profile and/or knowledge may be preferred by the learning system.

Finally, non-linearity enables the consolidation of the different types of learning and teaching: face-to-face learning and project based learning supported by e-learning. This simplifies the inclusion of the outcomes of the different types of teaching.

2 Related Work

The international project *Atlantis University* (Bleimann, 2004) is the first development of the extended blended learning concept. It is an ongoing project, so parts are missing but it already demonstrates direction in the area. Some goals proposed in this paper have been realised within the e-learning project *Environment for Learning and Teaching* (ELAT) (Gojny et al., 2003). However, due to the lack of interactivity and efective authoring environment, further developments and concepts are required.

At present, existing learning environment's authoring tools are limited to the e-learning part of extended blended learning and do not address important learning tasks such as face-to-face learning and project based learning. Further examination of e-learning systems shows most of them (for example *Blackboard* (Blackboard Inc., 2005), *TopClass* (WBT Systems Ltd., 2005) and *WebCT* (WebCT, Inc.)) don't clearly indicate the supported didactical methods and models. Additionally, the possibilities for adaptation are limited (van Rosmalen and Boticario, 2005). The impression with many of those e-learing systems is, that they "are more or less technically focused solutions created by technically oriented individuals, who have not taken pedagogical nor didactic considerations into account. [...] I [...] spoke with two of the programmers, who admitted to not having done any user nor pedagogical research, but 'had made some assumptions"' (Brückner, 2005).

movii (movii, 2005) is a very interesting concept for a hypermedia learn- and design-system. Firstly, it features interaction and user adaptation. By providing various *core*s and *scene*s inside of *act*s, learners may view the content in different styles, with a variety of media and different depths. However, because it's comparable to adventure games' *string of pearls* (Laird, 2003), movii doesn't provide the facility to change the order of the learning path's scenes.

3 Supporting Concepts

The authors of this paper propose an *Interactive Digital Storytelling* approach for *Non-Linear Extended Blended Learning*, because the demands of Digital Storytelling and e-learning are comparable (Koper, 2005). In both domains content has to be presented in a coherent and user centred manner. Time constraints are important to manage time limited situations as lectures or semesters. "Game over" situations should generally be avoided, except for tests. Additionally immersion and suspense can be exploited to learn more effectively.

3.1 Digital Storytelling

Storytelling is the most universal form of human conversation. Regardless of whether there is something to narrate or to explain – humans do this by telling each other stories. Many years ago, there was only a small percentage of people with access to books – therefore, the storyteller often was a real person telling news, stories, etc., interacting with his audience. When books became popular and people developed the ability to read, the storytelling job began to get more sophisticated. Since there is usually no possibility for the reader of a book to inquire

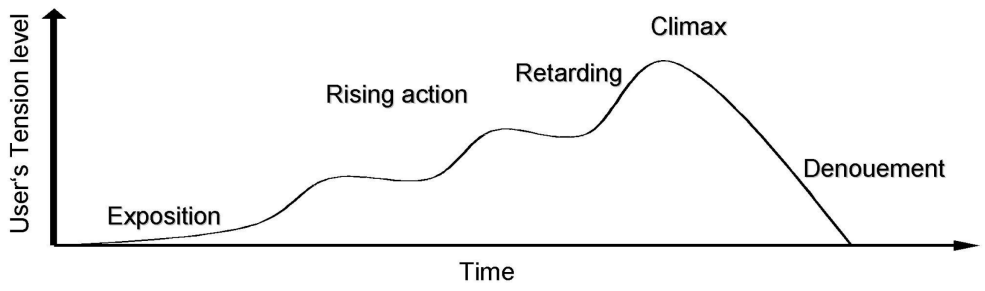

Figure 1: Suspense-arc according to Aristotle.

about certain inferred aspects of the story, artistic rules for telling a story through a book were developed over time. The same holds true when examining the movie or TV sector. Today, authors can make use of a whole new world of possibilities to tell their stories, ranging from direct worldwide access of content and 3D visualisation of content to interactive possibilities for the audience.

Digital Storytelling is the research area based on narrative structures (Braun, 2002). Because every human is used to stories and therefore understands them well – much better than the normally used point-and-click and desktop metaphors of present day graphical user interfaces – the goal are everyday applications with storytelling based human computer interfaces.

Digital Storytelling applications motivate users to carry on by giving him an experience of *immersion* in the content presented. This immersion is enabled by the feeling of *suspense*. Aristotle described the well-known suspense-arc with a five act structure: Exposition, rising action, retarding, climax and denouement (figure 1).

Beside immersion and suspense further fundamentals of Digital Storytelling are:

- The content presentation comes always to an end over a specific period, regardless of the user's behaviour.
- Unlike games, "game over" situations have generally to be avoided as these frustrate users (Kelso et al., 1992).
- The coherence of content presentation has to be assured.

The core technology of a narration engine (figure 2) consists of a story engine and a scene engine. The story engine loads a story model – a global description of the narration type (for example novella or fairy tail) or even the description of a module. Second, the content description for a specific narration is loaded. The content description describes the scenes and their coherence. In conjunction with the general runtime set-up information like an user-description and the specific period, the story engine is able to pick out scenes in the accurate order at the right time to gain suspense.

At start-up, the scene engine loads the content description as well. The story engine tells the scene engine which scene has to played in which context. With a scene script and additional environment information, it plays the scene interactively. Thus it controls the renderer and the input/output management.

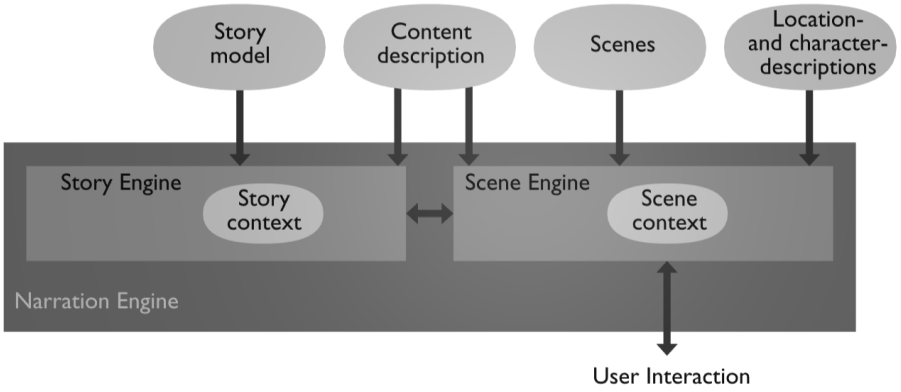

Figure 2: Diagrammatic plan of a narration engine.

Various edutainment projects have been realised with Digital Storytelling concepts, for example *Geist* (Kretschmer et al., 2001) and *EduTeCH* (Schneider, 2004). Within the first scenario of *Virtual Human* (Göbel et al., 2004), a story engine has been used to manage the content of a course in a mixed reality class room, where a real pupil (the user) learns with virtual teachers and virtual pupils.

3.2 Authoring

Most lecturers prepare their courses in a linear way as lecture notes and -slides. Fortunately they are also experienced in the use of non-linear presentations during the lessons – for example when discussing and answering the students' questions. Hence, an authoring environment should be designed with this fact in mind. To let lecturers feel comfortable with the authoring environment, the courses should be authored linear-like, but the environment should push the authors smoothly to non-linearity (Schneider, 2002).

Of course, there will be the demand of changing a published Unit of Learning. Some topics may have changed because of further developments or to optimise the manner of presentation.

Interactive Digital Storytelling provides user friendly authoring concepts (Schneider et al., 2003). These concepts are a good basis for the development for a non-linear extended blended learning authoring suite, but they have to be adapted to the learning environment as well as to the intended users. These are lecturers and students, both acting on par as authors.

4 Non-Linearity and Extended Blended Learning

As mentioned above, non-linearity should not be apparent to the user. This can be accomplished in various ways:

- Time Management
  If there is a given time for a module, say, 90 minutes, the system should present the most important Units of Learning. If the learner is fast enough, the learning system may present additional content such as more in depth explanations or practical examples.

- Assessments
  The learning system might be influenced by the correctness of the learner's answers to assessment questions. For example in the case of wrong answers the topic should be explained once more (in a different way) instead of only complaining about the wrong answer.

- User Tracking
  The learning environment should track and interpret each user (inter-) action. If the user pushes a "next" button, of course he wants to read further on. But it's also interesting, *when* he wants to continue. If he needed a long time for a page, he might had some problems in understanding it – or he just went to the kitchen to get a cup of coffee.

The integration of this work with the existing extended blended learning platform of Atlantis University is a major goal. Therefore, its ideas and technologies have to be used and integrated from the very beginning. This demands a *Moodle course management system* (Moodle, 2005) compliant and therefore a *Sharable Content Object Reference Model* (Alexandria ADL Co-Laboratory, 2005) compliant development, because Atlantis University is based on these technologies. Since version 1.3, SCORM provides sequencing and navigation in combination with its runtime environment.

As an overall content management system, the *Learning Design* specifications (Olivier and Tattersall, 2005) match very well with the proposed concept. It is very flexible, tested in a wide area of e-learning applications and projects and is related to some aspects of Digital Storytelling. Its design enables the implementation and adaptation of fundamental Digital Storytelling features, like easy-to-use time constraints and role-behaviour. It facilitates the integration of face-to-face learning, e-learning and project based learning, because the Learning Design specifications were developed to describe an unlimited number of pedagogical approaches by abstracting from those described in the literature (Reigeluth, 1999).

However, Learning Design does not provide any interaction-logic or render functionality. Therefore, there is a requirement for support from other applications. One solution might be accomplished via XSLT for transforming Learning Design's XML-output to HTML and ECMA-Script for programming the user-interaction, but a more flexible solution could provide a richer learning environment. Commercial applications like Flash or Director have high costs and are not available for all platforms. This is not acceptable for distributed and collaboration environments. Examples of free available user interaction environments are *Blender* (Roosendaal et al., 2004) for 3D purposes and *Scalable Vector Graphics* (World Wide Web Consortium, 2005a) using the *Synchronized Multimedia Integration Language* (World Wide Web Consortium, 2005b) for 2D environments.

5 Conclusion and Future Work

This paper shows the benefit of a non-linear interactive extension to the Extended Blended Learning platform. It proposes an Interactive Storytelling approach for runtime and authoring purposes and discusses a possible way of realisation. The next steps of research are intensive talks with the intended users to determine their needs in detail (for example favoured usage and required functionality). Following this analysis, the platform will be specified. At each subsequent stage of development users' feedback will decide further progression within the iterative development process.

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