

Chapter 16

Personalized, Adaptive Digital Educational Games using Narrative Game- Based Learning Objects

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ABSTRACT

Storytelling and gaming approaches are used as motivational instruments for suspenseful, engaging learning. This chapter describes the concept of Narrative Game-Based Learning Objects (NGLOB), providing a model of how to combine these different axes (narration, gaming, and learning) and how to apply it within personalized, adaptive Digital Educational Games (DEG). From a research perspective, this results in one of the main technical challenges of Serious Games (SG): personalization and adaptation. Here, the central question might be summarized with “How does one create and control a game during play considering the game context and characteristics of individual users or user groups?” This question and the use of NGLOBs are illustrated through the example of “Save the Earth” for teaching and learning geography.

INTRODUCTION

Regarding educational games, the motivation to learn is proportional to the fun of the game. Thus, it is desirable to adapt such a game to the player's preferences. While some prefer action

games, others prefer story-based adventures or Role-Play Games (RPGs). It is certainly not possible to create an own game for each type of player but it would be a great advance if an educational game was flexible and customizable enough to be able to adapt to the heterogeneous needs of different players preferences by using adaptive technologies. Hereby, adaptation and adaptiv-

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ity should consider the selection of appropriate content and presentation forms to teach subjects and skills of a curriculum as well as the speed and order of learning units in order neither to bore nor overstrain students. Furthermore, what people like to play depends on various non-static factors, like skills, mood, etc., which can change during play. Consequently, the game ideally would keep track of these factors and adapt accordingly during play. Concerning motivational aspects, the game should contain an interesting, suspenseful, and entertaining story, and be challenging, but not too stressing. Providing a good and suspenseful story however, is often a restricting factor to the variability of a game. This chapter wants to discuss these aspects and describe the concept of *Narrative Game-based Learning Objects* (NGLOB's) combining these elements. As example to illustrate the NGLOB concept, the *Digital Educational Game* (DEG) 'Save the Earth' for teaching and learning geography –elaborated within the context of the EU project 80Days – is considered.

BACKGROUND

For adaptation to the player's preferences, a player model is necessary. A lot of research in the field of player modeling has been done up to now. One of the first player models was designed by Bartle (1996). Houlette (2004) introduced a player model which keeps track of several player traits to create a model which can be used to adapt the behavior of *Non-Player Characters* (NPCs). In this context, Yannakakis and Maragoudakis (2005) showed how to improve a player's experience during a Pacman game by an adaptation of the opponents' behavior according to the player's skill by use of an adaptive player modeling. Magerko, Heeter, Fitzgerald and Medler (2008) designed a game for teaching microbiology concepts called S.C.R.U.B., which can be personalized according to a player type chosen at the beginning by answering a questionnaire. The chosen model however is

static for the whole game and does not consider adaptation based on the learning context. Cowley, Charles, Black and Hickey (2008) propose a game adaptation mechanism based on a continuously updated factorial player modeling with varying factors for different game genres. In the context of storytelling, the system Passage (Thue & Bulitko, 2008) uses player modeling to adapt the game's story individually to the type of player. In *Façade* (Mateas & Stern, 2005) the player can join an interactive story which adapts its agents' behavior according to the players' actions.

For adaptation to storytelling metaphors, a story model is necessary. Here, the basic idea is to use well-proven story structures in order to 'guarantee' suspenseful stories. The most prominent examples for story structures in that context of story-based edutainment applications (and entertainment genre in general) represent the Writer's journey (Vogler, 1992) respectively Hero's Journey (Campbell, 1949) as well as the Hollywood film model (Field, 2005) (See Figure 1).

From a Storytelling perspective the narrative paradox and the question how a Story-based DEG continues during run-time (→ macro adaptation, sequencing) has been at core of research within the first period of the 80Days project and previous work of the authors of this chapter (Hoffmann, Göbel, Schneider, & Iurgel, 2005; Kickmeier-Rust, Göbel, & Albert, 2008). As outcome of comprehensive analytic studies and conceptual work, a compromise between plot-based Storytelling and non-linear, interactive gaming approaches has been identified (Göbel, Malkewitz, & Becker, 2006; Göbel, Mehm, & Radke, 2009) and built the conceptual basis for the overall story structure of the demonstrator 1: The Hero's Journey (Campbell, 1949; Vogler, 1992) which is well-proven especially in the domain of adventure games, was used as underlying (in major parts linear) story model in order to 'guarantee' a suspenseful story. Hereby, the middle part with the dramatic step 'The Road of Trials' is very flexible and provides

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