

1. PUBLISHABLE SUMMARY

Computer games have become an incredibly successful part of today's entertainment landscape. With increasing time people spend on computer games, the idea of utilizing their motivational and didactic potential for educational purposes is getting more popular and fascinating. The European research project 80Days (www.eightydays.eu) is inspired by Jules Verne's novel "Around the world in eighty days". The project aims at developing the necessary psycho-pedagogical and technological foundations for successful digital educational games – successful in terms of educational effectiveness as well as financial turnovers.

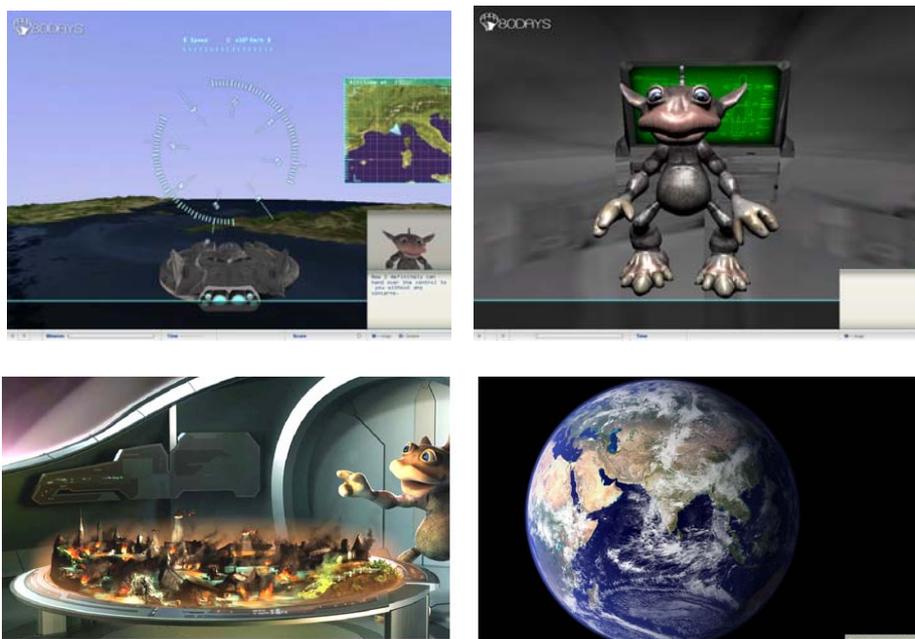
The basis for 80Days' mission is an intelligent technology that allows an adaptation to individual learners, their prior knowledge, abilities, preferences, needs and aims. By this means the learner will have optimal motivation to play and therefore to learn, because s/he is perfectly challenged, and neither overburdened by too difficult gaming and learning activities, nor bored by too simple ones. In 80Days, this kind of adaptation is realized by providing the learner with adequate psycho-pedagogical interventions (e.g., hints or feedbacks) but also by the adaptation of the entire gaming context and ambience (e.g., the level of difficulty, the mood, the pace, or even the entire storyline). The very nature of the 80Days project is melding adaptive educational technology with interactive and adaptive storytelling. In the rich context of DEGs with their large degrees of freedom, individualization as well as adaptation requires an in-depth understanding of the learners and their behaviour within a DEG. Another challenge is not destroying the flow of the gaming experience by educational guidance and knowledge assessment procedures. To meet these requirements, cognitively sound models of a learner's behaviour within virtual learning environments are essential. Moreover, while traditional approaches to adaptive educational technologies primarily focus on knowledge and learning progress, digital games constrain the consideration of aspects such as individual preferences (e.g., visual styles or gaming genre), individual motivation, collaboration, or (problem solving) behaviour. Existing, primarily competence-based, cognitive models for adaptive educational technologies must be merged with theories of (achievement) motivation and models of interactive and adaptive storytelling in order to establish a comprehensive theoretical framework for combining learning and gaming.

A weak spot of utilizing digital games for educational purposes is the high level of development costs, in terms of assets production and didactic design. The overall costs for developing DEGs, however, must be justified by educational efficacy, by an appropriate balance between gaming and learning, and - most importantly - by the market for specific educational game genres. The reduction of development costs is a crucial factor for publishers of educational material and game developers in so far as the market for games with specific educational aims can be considered to be significantly smaller than the global market for recreational or commercial games. Therefore, a technological as well as psycho-pedagogical framework must be established that enables to reduce the costs and shorten the development lifecycle. Essentially, this shall be accomplished by providing generic frameworks and models for adaptive interventions, interactive and adaptive storytelling, the (re-)use of one base game to create multiple games by realizing different game scenarios and even entirely different games on the basis of a single pool of (expensive) game assets (e.g., 3D objects), and the integration of existing learning resources. This methodological framework shall allow either publishers, educators, or learners to choose from different classified game genres and styles as well as from different learning-related factors (e.g., the learning goals or preferences) in order to realize tailored learning experiences. Making development more effective also includes theoretically and empirically sound evaluation and validation methods.

The project's achievements in the first 24 months are outstanding. 80Days has significantly advanced the state of the art in the application of personalised technology-enhanced learning techniques to digital educational games by an advanced level of research work.

Psycho-pedagogical research made significant progress by elaborating a joint formal model of cognitive educational assessment on a probabilistic level, the provision of suitable support and interventions, and open, interactive, adaptive storytelling. From a technical point of view we developed a comprehensive multi-adaptive system, integrating assessment engines, reasoning services, adaptation engine as well as a software engine driving the story telling and story pacing. Thus, within the project a real-time knowledge driven approach to implicit learner competency assessment has been realised. This modelling of the learner enables both micro and macro personalisation.

As a manifestation of research achievements, the project developed two amazing demonstrators. On the one hand a compelling educational game teaching geography. The code of the game is Lizard. Lizard is a learning adventure that is supposed to teach geography for the age group of 12 to 14 years. The curriculum includes, for example, knowledge about the planet Earth such countries or cities but also aspects such as longitude or latitude. In the game the learner takes the role of a boy or a girl (depending on the learners' gender) at the age of 14. The story starts from an extraordinary event; a space ship is landing in the backyard and an alien named Feon appears. Feon turns out to be a friendly alien, being an alien scout who has to collect information about foreign planets, in this case planet Earth. The learner accompanies Feon and is having fun with flying a space ship and exploring interesting places on Earth. Feon creates a report about the Earth and its geographical features. This is accomplished by the player by means of flying to different destinations on Earth, exploring them, and collecting and acquiring geographical knowledge. The goal is to send the Earth report as a sort of travelogue about Earth to Feon's mother ship. At a certain point in the game,



Screenshots of 80Days' demonstrator game, code name Lizard, teaching geography for a target audience of 12 to 14 year old children.

however, the player makes a horrible discovery; the aliens are not really friendly but collect all the information about Earth to conquer the planet, lately. This discovery reveals the “real” goal of the game: The player has to save the planet and the only way to do it is to draw the right conclusion from the traitorous Earth report. The subject matter is embedded in that story and learning occurs at various events in the game. From a pedagogical point of view, learning occurs by receiving information (e.g., seeing/reading something in the game or hearing something from Feon or other game characters), problem solving (e.g., reducing the negative impacts of a flood by appropriate “terra-forming”), or imitation (e.g., watching other game characters and learning from their behaviours).

In addition to the immersive demonstrator game, we developed a demonstrator to potentially show the full capabilities of our technological approach to multi-axes educational adaptation. The code name is Bat Cave. Bat Cave mimics a complete game and allows the beholder to explore various kinds of adaptive mechanisms. The demonstrator is composed of an interaction part and a control panel. On the interaction side, Bat Cave ‘explains’ what is happening and allows the user to interact with the game in a simple form. In the control panel the user can monitor what the adaptive technology behind is doing. For example, the user can monitor a specific learner’s paths through a game’s different storylines or the learning process and how it is supported by 80Days’ adaptive technology. Bat Cave works closely together with StoryTec, a powerful authoring tool to generate multi-adaptive game lines.



Screenshots of 80Days’ authoring tool StoryTec (left panel) and the related demonstrator Bat Cave (right panel).

Finally, in the third period, we developed a third demonstrator strand, named “Atlexicon”, which is supposed to demonstrate the re-usability of the developed contents and assets outside of a computer game. In that sense, Atlexicon is a demonstrator of an interactive Atlas.



Screenshots of the Atlexicon demonstrator, an interactive Atlas.

To complete the lifecycle of research, design, development, in a next step, the demonstrators were subject to in-depth evaluation activities with schools in the UK and in Austria. Empirical findings of more than hundred participants yielded beneficial effect of adaptive interventions and an overall satisfying usability and user experience. Implications for the future development of the game prototypes and the design of evaluative activities have been drawn. In particular, the theoretical knowledge and practical experience thus gained will contribute to advancing the research area of evaluating usability and user experience in digital educational games.

Finally, the project was highly successful in disseminating its achievements. In total, the consortium published 8 articles in peer review journals, attended several conferences and other events in total, the dissemination activities sum up to over 100 events and publications. The strongest impact might have the books, (to be) published by the project; this refers to the Workshop proceedings, published in October 2009 and, more importantly to the methodology guide book, to be published in late 2010.