Chapter 4.10
Games-Based Learning, Destination Feedback and Adaptation:
A Case Study of an Educational Planning Simulation

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ABSTRACT

Serious games are suitable for learning. They are a good environment for improving the learning experience. As a key part of this setting, feedback becomes a useful support for decision making and can reinforce the learning process in order to achieve certain objectives. Destination feedback allows users to draw on strategies and improve skills. However, too much feedback can make the learner too dependant on external advice when taking the next action, resulting in a weaker strategy and a lower performance. In this chapter the authors introduce a conceptual approach to feedback in E-Learning with serious games; how useful or harmful it can be in a learning process. They describe a case study carried out with a simulation of an educational planning task. The authors studied the performance of 43 learners who had, or did not have, visual destination feedback in a problem solving task. They conclude that in this context, too much assistance can be counterproductive.

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INTRODUCTION: AN APPROACH TO ADAPTATION, E-LEARNING AND GAMES-BASED LEARNING

Serious games have become an important topic in the recent and not so recent history of education. Gaming itself is becoming a key issue in education and has been widely researched in the last 50 years (Caillois, 1958; Huizinga, 1971). In the mid 90´s

the Internet started to provide new perspectives for serious games. A range of new possibilities arose, such as collaborative worldwide extended multi-player sessions, instant messaging, instant updating of settings and multi-language support. The array of features is still growing, and is not only attractive for *regular* users, but also for learners and teachers (Bruckman, 1993; Prensky, 2001).

Generic games that can be used for learning can cover any kind of non-educational games; for instance, the well-known Sims, SimCity, Flight Simulator, Pac-Man, FIFA, SuperMario Bros, Civilization, Rayman and Diablo II. (Dickey, 2005; Squire & Barab, 2004; Jenkins & Squire, 2003). All of them belong to different categories (*genres*) of games. Following the taxonomy produced by Crawford (1984), which focused on objectives and nature of the game, we find several well-defined categories, such as skill-and-action, combat, maze, sports, paddle, race, strategy or any other kind which is in the list. Goldsmith (1999) also describes another taxonomy: Trick Taking Card, Collectible Card, Exploration, Trading, Auction, Solitaire, Word, etc. Prensky (2001) defines a similar taxonomy based on objectives and nature but follows a different categorization focused on pairs of opposite features (e.g. intrinsic versus extrinsic, reflective versus active, single-player versus multi-player). With a more theoretical perspective drawn before the digital era, we can resort to the first taxonomy on games ever made by Roger Caillois (1958), although it fits only partially with the aim of this text, as it concerns the pre-personal computers and consoles era, and therefore, also pre-digital games-based learning.

With such a variety of available games and genres it is very easy to find several direct applications and consequences among them, as can also be found in learning. For instance, games allow players to experience, to try, to improve skills, to learn content and to practice strategy (Turkle, 1995; Piaget, 1962; Vigotsky, 1978; Arts, 2005a); they elicit emotional reactions in players, such as wonder, the feeling of power, or even aggression (Squire, 2002); they can also support rather accurate episodes of history (SEGA, 2005), real systems (Microsoft, 2006b), complex popular events (Interactive, 2004) or board games (Microsoft, 2006a), just to mention a few. In addition, with computer networks or network Serious Games on the Internet, they allow players to strengthen their social skills while using virtual communities alongside the games and the facilities of collective and shared games (Bruckman, 1993; Prensky, 2001; Arts, 2005b; Auralog, 2005).

In addition, there are several interactive learning techniques that can be used inside and/or around a game, i.e. learning by doing, learning from mistakes, goal-oriented learning, role playing, constructivist learning, adaptive learning and feedback (Prensky, 2001). Adaptive learning supports adaptivity (the ability to modify eLearning lessons using different parameters and a set of pre-defined rules) and adaptability (the possibility for learners to personalize an eLearning lesson by themselves). These two approaches go from machine-centered (adaptivity) to user-centered (adaptability) and can be used in combination (Burgos, Tattersall & Koper, 2007). Furthermore, we also define adaptation in eLearning as a method to create a learning experience for the student, as well as the tutor, based on the configuration of a set of elements in a specific period aiming to increase the performance of pre-defined criteria (Van Rosmalen, Vogten, Van Es, Van, Poelmans & Koper, 2006) (i.e. educational, user satisfaction-based). Elements to modify/adapt can be based on content, time, order, assessment, feedback interface and so forth (Burgos, 2008).

The implementation of adaptive learning within a game, along with other techniques, can improve the learning process as well as the user involvement. This involvement provides a *de facto* bi-directional communication flow, where the game stimulates the active role of the user, who in turn gives a feedback that provides some influence to the game itself. Therefore, we can use