

# Chapter 11

## A Theoretical Background for Educational Video Games: Games, Signs, Knowledge

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### ABSTRACT

*The potential of video games for learning is now widely accepted among the community of Educational Technology. However, there is a critical lack of guidance for the design of educational games. In order to provide such guidance, there is a need for a solid theoretical basis regarding the nature of learning in games. This chapter redefines what a game is, in semiotic terms, enabling four groups of strategies to be formally identified, depending on how the knowledge to be acquired is inserted into the game. These four groups are: systemic learning, when knowledge is embedded in the game mechanics; winner strategies, when the game provides an environment in which knowledge is required to reach the game's goal; loose coupling, when knowledge is arbitrarily required to unblock the progression towards the game's goal; and contextual coupling, in which the game serves as a context for the exposition of static learning material.*

*This theory is then put into practice by analyzing three commercial educational games. It constitutes a first step towards Instructional Game Design.*

### INTRODUCTION

The potential of video games for learning is now widely accepted among the community of Edu-

cational Technology (Quinn, 1997; Jones, 1998, Amory, 2001; Rieber, 1996; Prensky, 2001; Gee, 2003). Contrary to common belief, play and games are not specific to children, but constitute an essential activity for adults too (Huizinga, 1938; Rieber,

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1996). Play is not frivolous but can be quite serious (Rieber, 1996). The recent explosion of computer and video games in modern culture makes it even more obvious that games are to be considered as a new medium, with unique properties.

Among the most cited advantages of video games over other instructional technologies are their motivational appeal and their compatibility with modern pedagogy (Kirriemuir & McFarlane, 2004, p. 19).

In terms of motivation, it is argued that games are intrinsically motivating; players are motivated to play regardless of the consequences of the learning activity (Malone & Lepper, 1987; Jones, 1998). This is related to one fundamental characteristic of a game: the fact that it has no perceived utility for the player (Huizinga, 1938). Games are played because they provide a multitude of emotions, such as fear, surprise, pride, relief, etc. and have other motivational aspects such as challenge and fantasy. Given this intrinsic motivation to play, several educational games have been developed, including all the games considered as “edutainment”. While it has been shown that games in certain contexts provide higher levels of motivation of engagement than traditional education (Wishart, 1990 in Hays, 2005), the level of engagement or “gameplay” of these titles seems lower than in pure entertainment games (Hagbood, 2005), as if adding pedagogical constraints to a game diminished the motivation. In other terms, “making learning fun”, as stated by Malone & Lepper (1987) remains a difficult task (Hays, 2005).

In terms of pedagogy, the active nature of games encourages learner-centered pedagogy. As described by Rieber (1996), play is a natural learning strategy for children according to the Piagetian theory; this makes video games suitable for computer-based learning. Game-based learning is usually associated to the situated learning theory (Brown, Collins & Duguid, 1989), because in many games, especially 3D games, any action has a meaning within a situation in the game

(Gee, 2003, p. 84). However, in many educational games, the player’s actions are not used to promote situated learning. Indeed, among players’ actions, some are dedicated to learning while others are purely for the game play, resulting in a dissociation between game and learning which is contrary to situated learning. This insufficient integration between game and learning is also reported by several research studies (Malone & Lepper, 1987; Kirriemuir & McFarlane, 2004; Hagbood, et al., 2005; Szilas & Sutter-Widmer, 2009).

Besides, using existing games for educational purposes is very difficult, since the games were not designed for that purpose. For example, several practical difficulties are reported when using commercial history strategy games to learn history in a classroom environment (Egenfeldt-Nielsen, 2004; Connolly & Stansfield, 2006).

This short overview leads to the conclusion that there is a need to design educational games that better exploit the pedagogical potential of computer games, but also that we lack guidance for such design. As far as learning is concerned, the field of Instructional Design (in the broad sense of the term) is dedicated to providing guidelines on tools/methods for organizing learning content and activity, should the tools/methods use computer or not (Reigeluth, 1999). On the game side, the field of Game Design provides more and more established methods to design games with a good gameplay, in terms of balancing for example (Salen & Zimmerman, 2003). Each of these two design-oriented fields fails however in providing relevant methodology for educational games. Instructional Game Design (IGD) should emerge to improve the quality of current educational games. More specifically, the goal of IGD is to find a methodology making it possible to produce an efficient learning game from any given knowledge domain, if such a game is possible. Very few attempts towards IGD can be found so far, and they remain preliminary (Dickey, 2005; Kiili, 2005; Amory, 2007). These attempts tend

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