Chapter 3
Multiple Intelligences and Digital Learning Game Design: How to Consider the Intelligences of Players?

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ABSTRACT

Empirical research that draws a framework on how the theory of MI could be incorporated in (learning) games is non-existent. Furthermore, the theory of MI fits well into the concept of individualization, as it distinguishes between individuals in terms of their abilities. In light of this, the chapter reports on the first evidence-based set of mappings between this theory and fundamental constructs of games known as mechanics. These mappings can be utilized by designers in the individualization paradigm of player-centered game design as guidelines on what mechanics to include in their design when targeting an audience with specific MI profiles. Such individualization can potentially positively affect the game experience of players while establishing the proper frame for affecting learning. As such, these mappings, available in form of a recommendation tool, act as guidelines on how to design (learning) games while considering the intelligences of the target audience.

INTRODUCTION

Since the advent of modern computers, technology has increasingly become an important part of learning environments (Garrison, 2011; Koehler & Mishra, 2009; Rosenberg, 2001). Over the past decades, prevalent computer-supported learning systems have emerged. These systems appeal to educators as they support rich content and have the potential to reach large populations while maintaining an individualized experience. In education, individualization is argued to be an effective way to positively affect the

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learning outcomes of people (see e.g. (Tseng, Chu, Hwang, & Tsai, 2008; Yasir & Sharif, 2011)). Individualization is the opposite of the "one-size-fits-all" approach often used in classical learning environments. A variety of terms are used to refer to this principle: e.g. learner-centered design, personalization, adaptivity, and adaptation. In this chapter, the term individualization is used to refer to this principle.

In recent years, interest in the use of rich and sophisticated media forms, such as games for educational purposes has increased. Games have the potential to provide fun, engaging, and motivating learning environments to support players in learning new concepts or acquiring new skills and/or behaviors (Dondlinger, 2007; Gee, 2004; Paras & Bizzocchi, 2005; Wouters, van der Spek, & van Oostendorp, 2009). In the literature, a variety of terms are used to refer to games for learning. This includes terms like educational games, edutainment games, serious games, and learning games. The term learning games will be used throughout this chapter to refer to this concept.

Strategies such as learner-centered design (called player-centered design in the context of games), and individualization are already given due attention in the domain of learning games (e.g. (Chanel, Rebetez, Bétrancourt, & Pun, 2008; Lopes & Bidarra, 2011; Magerko, 2009; Muir & Conati, 2012; Yannakakis et al., 2010)). It is often argued that by considering the needs, abilities and preferences of players, one could create games that can positively influence both the gaming experience and learning outcomes (discussed further in section 2). Various conceptual frameworks on individualized learning through games have proposed different factors that could contribute to the process of individualization (see e.g. (Charles, Kerr, & McNeill, 2005; Kickmeier-Rust, Mattheiss, Steiner, & Albert, 2012; Lopes & Bidarra, 2011; Sajjadi, Broeckhoven, & Troyer, 2014)). These range from factors used to drive the individualization, such as different aspects of the player and how they can be measured, to aspects of the game that can be subject to individualization, over strategies for when and how to apply individualization. The research presented in this chapter and its contributions to the state of the art in the domain of learning games are directly related to one of the least explored aspects of the players to drive individualization, more precisely, the intelligences of players with respect to the "Theory of Multiple Intelligences" (MI) (Gardner, 2011). Furthermore, game mechanics are considered as the aspect of the game subject to the individualization based on players' intelligences (section 3). As such, this chapter presents the first evidence-based set of mappings between the different MI dimensions and fundamental constructs of games, i.e. game mechanics, which can be used to tailor the design of games based on the MI profile of the target audience. Moreover, this chapter takes a first step in demonstrating that such individualization could result in better game experiences as well as higher learning outcomes (section 4).

INDIVIDUALIZATION

Individualization in contemporary settings is defined as tailoring the digital learning environment to the individuals' needs, abilities and preferences (Beldagli & Adiguzel, 2010; Brusilovsky, 2001; Kickmeier-Rust & Albert, 2010). In the context of game-based learning, tailoring the learning environment to the individuals can be achieved in different ways and at different stages. Tailoring can be done in advance (during design, i.e. player-centered game design), at the start of playing the game/level (often called static adaptation or personalization), or completely dynamically while playing (often called dynamic adaptation or adaptivity). Numerous researchers have defined the terminology associated with individualization (e.g. (Beldagli & Adiguzel, 2010; Göbel, Hardy, & Wendel, 2010; Linssen, 2011; Lopes & Bidarra, 2011)). In the case of adaptation and personalization, a rather generic version of the game (learning system) is