Chapter 2.15

Development of Game–Based Training Systems:
Lessons Learned in an Inter–Disciplinary Field in the Making

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ABSTRACT

Modern computer gaming technology offers a rich potential as a platform for the creation of compelling immersive training systems, and there have been a number of game-based training systems developed in recent years. However, the field is still in its infancy. Improved understanding is needed on how to best embed instruction in a game and how to best use gaming features to support different types of instruction. Further, the field is inherently inter-disciplinary, requir-

ing instructional system designers, software developers, game designers and more, yet there are no established development methodologies to ensure effective coordination and integration across these disciplines. The authors introduce a collaborative effort that is investigating how to improve the craft and science of game-based training. They present their experiences in creating a flooding control training system for the U.S. Navy Recruit Training Command, and discuss the inter-disciplinary development issues that they encountered. They present the lessons they learned and their views on how to advance current methods to support the consistent production of effective game-based training.

INTRODUCTION

Computer games of various kinds have been used for education and training purposes for over two decades with varying degrees of success (O'Neil et al., 2005; O'Neil & Perez, 2008). As computer gaming technology has matured and increased in capability, the opportunities available for delivering immersive learning experiences have increased (Bonk & Dennen, 2005; Hill et al., 2006; Hussain et al., 2008; Johnson et al., 2007; Roberts et al., 2006), and so has the challenge of creating experiences that are pedagogically effective (Diller et al., 2004; Hussain & Ferguson, 2005). A training game is imbued with a purpose - to provide experiences which lead to specifics gains in the student's knowledge and/or skills. A good training game will consistently balance the instructional goals with the goal of motivating the player. However, a poorly designed training game will sacrifice one or more fundamental elements of the gaming experience in order to attempt to satisfy the training goals, or will sacrifice effective pedagogy in order to attempt to keep the game compelling. The former may be a great training system, and even a great simulation-based training system, but doesn't pass muster as a game-based

training system since the players don't enjoy it. The latter may be a great game, but doesn't pass muster as a training system since it does not produce the desired learning outcomes. Developers of game-based training systems know this, but achieving this synergy between instruction and engagement is a poorly understood art.

The challenges facing us as a discipline are:

1) An enhanced understanding of the elements of game design and pedagogical design that are crucial to game-based training and how to balance those elements effectively,
2) An enhanced understanding of how to assess the success of a game-based training application, and
3) The creation of development methodologies that lead to repeatable successes, especially for non-commercial training programs that are limited in the scale of effort that can be supported.

We introduce the initial results of a multi-disciplinary effort sponsored by the Office of Naval Research to directly address the issue of how to best create effective educational immersive computer games. The team for our project included researchers and content developers from the fields of instructional design, story-based training and entertainment, movie production, human performance assessment, game engines, commercial games, game-based training systems, simulation and modeling, intelligent tutoring systems, graphic design and modeling, system integration and educational science. As professionals in our respective fields, we each brought different perspectives on the interactions of different aspects of gaming and pedagogy to the table.

Our effort had two mandates. The first was to conduct applied and empirical research on tools and methods for enhancing the art and science of educational games. In particular, our initial focus was on identifying extensible design and development methods that support efficient cre-

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