

## Chapter 3.10

# Hybrid 2D/3D Development of Interactive Simulations

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### ABSTRACT

Three-dimensional virtual learning environments provide students with pedagogic experiences beyond traditional two-dimensional textbook and Web page content. When delivered via the World Wide Web, this technology is known as Web3D. Such immersive learning experiences are available to a wider audience of student and when coupled with existing 2D content make effective learning applications. In this chapter a method for delivering a 2D/3D hybrid Web page will be demonstrated, which illustrates a best of both worlds approach to including both traditional text-based content and 3D simulated environments in an e-Learning context.

DOI: 10.4018/978-1-60960-195-9.ch310

### INTRODUCTION

Three dimensional (3D) Virtual Learning Environments (3DVLE) provide invaluable potential for education by providing three kinds of knowledge-building experiences not afforded in the real world (Winn 1993); size, transduction and reification.

Size in a 3DVLE is relative and scalable. Students can enter microscopic worlds and see the inner workings of an atom or the structure of a molecule. On the other hand, students can experience god-like views of the earth's surface or experience the relative size of our solar system with respect to the entire Milky Way galaxy. A 3DVLE provides zooming-in and zooming-out encounters not available in the real world or any other environment.

In addition, data in 3DVLE presents to students in ways not possible in the real world via transduction. Students can experience a world through the infrared sight of insects, see the sonar communications of dolphins as rendered sound waves or speed up events to experience the sprouting of a seed. Transduction means the student experiences in first-person other environments (through sight, sound and touch) and constructs first-person knowledge about situations and concepts they could only experience from a third-person point of view in the real world.

Finally reification emphasises the most important pedagogical aspect in 3DVLE design; realisation not simulation. The most popular first environment an educator empowered with the tools to create 3D virtual world constructs is an electronic replica of the real world. This is simulation. While this technique is useful for immersing students into real environments which they may never experience in person during their studies it does not take advantage of the 3DVLE medium. Reification removes the simulation and focuses on the subject at hand. For example, if the learning experience is to examine the formation of DNA strands, a 3DVLE of a laboratory with microscopes through which the virtual embodied student can look to see the DNA adds nothing to the experience. In this example, the subject is neither the microscope nor the laboratory in which the student must use these virtual transducers to learn about DNA. A more appropriate application is to have the student experience DNA formation at the microscopic level in first-person through the scaling of their view.

Although the power of 3D in learning and teaching materials is evident, in recent times with the large push into 3D online communities, 3D is being used for the sake of technology and not to better the educational experience of the student. For example, existing educational materials in 2D image or text format bring no pedagogical benefit to students when they remain as 2D objects but are rendered on the side of a wall in a 3D world.

As such, this chapter introduces the concept of 2D/3D hybrid eLearning web pages in which the best features of traditional 2D web pages are merged with 3D learning objects. The chapter also provides a brief primer on the use of technologies for creating these hybrid applications and demonstrates a case study where a full real time 3D human skeleton is integrated with the text on a web page. The technology being demonstrated herein is known as Web3D.

## **ADVANTAGES OF WEB3D**

Web3D applications offer many advantages over traditional 2D content. It has been found that immersion in 3D environments is three times more effective in revealing structural information (Ware & Frank 1994). Web3D can support a suite of pedagogical experiences that are unique within current e-learning technologies (de Byl 2008). The worlds created in immersive 3D virtual reality environments are distinctively structured. The world creates a synthetic experience that captures the essence of being in a particular place or context, and replaces the traditional computer interface which sits between a learner and their computer-based educational material (Winn 1993).

This immersion enables learners to negotiate meaning based on their own personal cognitive, affective and kinaesthetic experiences rather than on the descriptions of others' experiences. It assumes learners will construct knowledge through non-symbolic, non-reflective, first-person psychological activity that occurs when they interact directly with worlds. Choices embedded within the worlds allow the learning focus to shift away from isolated pre-designed interactions, to a situation that encourages the learner to control, manage and direct their own learning. Once immersed within a world, learners can communicate, investigate and experiment either individually or in the company of other learners, to transcend geographical and temporal boundaries. Such conversations can be

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