SIGCSE 2009 Poster by Dr. Kris Stewart, SDSU

How 3d Game Programming can be Service-Learning

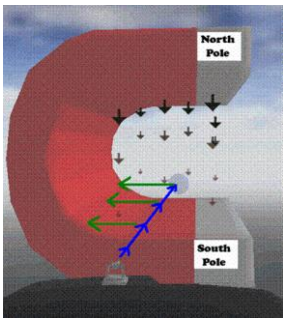
1 Introduction

Several in high performance computing acknowledge that we are “indebted to the gamers" for pushing the envelope on processor speed, graphics resolution and rendering capabilities of the PC hardware that the HPC community uses to build systems. This talk presents the upper division, university curriculum that has been developed over three years of teaching a topics class that engages our current "raised digital" undergraduates to demonstrate their creativity through programming a game that can be used in alternate situations. The module has been deployed in a high school physics course to demonstrate "Projectile Motion under Magnetic Force" and we propose that a game can be effectively used to promote HPC and other fields.

2 Game Programming as Service Learning

We developed projects to explore how the commercial Game Engines might be used to support Science Education, collaborating with the Visualization Services group at the San Diego Supercomputer Center (SDSC), led by Steve Cutchin, who suggested that the Torque Game Engine (TGE) [1] would be an appropriate cross-platform game development technology. The pricing from the maker, GarageGames, Eugene OR, was also attractive, initially $100 / seat for a license, access to full source code and membership in a vibrant user community that had been growing since 2000. The project is hosted on the SDSC Game Grid [2], where you can download the high school game called “The Physics Game.

We also collaborated with two high school science teachers at Hoover High School, geographically near SDSU, asking the teachers to identify 3d concepts in their curriculum which their student find difficult. Working with the teacher we would create a game-based learning module to be used in the high school computer lab. In physics, required topic selected from the California State Standards [3] chosen was 5n: Electric and Magnetic Phenomena. Meetings with Mr. Hal Cox of Hoover High, our student game-programmers and the author resulted in a model that used an over-sized C-Magnet to represent the Magnetic Force, see below.



The game goal is to fire a projectile at a target on the opposite side of the magnet, compensating for the influence of the magnetic force shown above. The undergraduates benefited from the opportunity to develop for a “client” away from campus and learned a valuable lesson to view from the eyes of the client and change their terminology of “First Person Shooter” (FPS, the standard term in the industry) to “First Person Point of View”, showing respect for the 1999 tragedy at Columbine High School. To distance the scenario from real-world “shooting”, the “player” is represented by a green alien holding a crossbow. The “projectile” is an arrow launched from a crossbow, see below.

3 Influences

Balancing the influences on one’s own campus with the vast professional world beyond, two individuals whose work has greatly influenced the author need to be mentioned: John Seely Brown and Jean M. Twenge.

3.1 John Seely Brown

3.1.1 The Gamer Disposition

John Seely Brown and Douglas Thomas [4] described the impact of today’s multiplayer games as establishing five key attributes of the gamer disposition:

‘They are bottom-line oriented
They understand the power of diversity
They thrive on change
They see learning as fun
They marinate on the “edge”’

Based on teaching 3d Game Programming for three years now, this describes the attributes in our current SDSU undergraduates and faculty continue to look for ways to capitalize on these traits.

3.1.2 Growing Up Digital (March/April 2000)

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John Seely Brown's article "Growing Up Digital: How the Web Changes Work, Education and the Ways People Learn" [5] had a profound impact on this author. January 18, 2005, Dr. Brown was invited to speak at San Diego State University by the Qualcomm Institute for Innovation and Educational Success [6]. This led to exploring other articles by Brown that caused this author to discover that although many faculty, this author included, may be of the "analog generation", our current students "grew up digital" and this background must be acknowledged and built-upon in our pedagogy. The author acknowledges that she still speaks with an analog accent.

Key points gained from Dr. Brown are to learn to capitalize on our students' creativity by honoring the vernacular of this "multimedia-literate" generation. We need to ensure we communicate complexity in a simple fashion and, by this example, encourage our students to develop this skill. Their future workplace is likely to have them working in multidisciplinary teams and their individual expertise will need to be communicated, and valued, by other team members whose expertise may well be deep, but specialized to another skill set and vocabulary. Brown also stressed the benefit of "learning in situ", modeling the team approach for development and critique within our classrooms. The SDSU 3d game programming course benefits from being scheduled in our Learning Research Studio which closely models MIT's architecture studio promoted by Dr. Brown where all work is done in public with many opportunities for critique and collaboration.

3.2 Jean M. Twenge – Generation Me (2006)

Dr. Jean Twenge's book Generation Me: Why Today's Young Americans are More Confident, Assertive, Entitled – and more Miserable Than Ever Before [7] is based on extensive studies of categorical (survey) data examining the differences in generations. The members of Generation Me are the children of the Baby Boomers, with boomers defined as the post World War II / pre Vietnan war generation. GenMe have been raised to have high self-esteem, though surveys reveal they feel their lives are controlled by outside forces, yielding apathy and cynicism. In the United States, this generation has grown up with the Equality Revolution legally in place four decades after the marches, such as the 1965 Selma marches, brought the Civil Rights Act of 1964. Members of Generation Me have been taught "equality". They feel entitled, but without a strong sense of duty.

Consider these findings and compare with the thoughts of John Seely Bown, especially from Section 3.1.1 on "Game Disposition".

4 Game Programming in CS Curriculum

At San Diego State an undergraduate curriculum was developed and taught three times as a topics course, which CS majors can use as an upper-division elective [8]. The formal curriculum for CS 583 3d Game Programming has been approved by the department and college and is now being vetted by the university curriculum process through the University Senate.

The student Learning Outcomes are

1. Students use the large, complex software environment provided by the game engine to develop their Object Oriented Programming skills through scripting.
2. Students develop communication skills through course exercises and assignments to be able to describe a complex software project to a variety of audiences.
3. Students work effectively as a member of a group to create a software product.
4. Students learn the capabilities and responsibilities of using the campus computer network and computer labs.

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References

[1] Torque Game Engine, GarageGames, Eugene OR http://www.garagegames.com/

[2] Game Grid, San Diego Supercomputer Center http://visservices.sdsc.edu/projects/gamegrid/

[3] California State Grades Nine Through Twelve – Physics Science Content Standards http://www.cde.ca.gov/be/st/ss/scphysics.asp

[4] John Seely Brown and Douglas Thomas, "The Gamer Disposition", Harvard Business Conversation Starter, February 14, 2008 http://conversationstarter.hbsp.com/2008/02/the_gamer_disposition.html

[5] John Seely Brown, "Growing Up Digital: How the Web Changes Work, Education and the Ways People Learn", Change, March/April 2000 http://www.johnseelybrown.com/Growing_up_digital.pdf

[6] John Seely Brown, "The Future of Education in a Digital Age", SDSU speech January 18, 2005. http://pict.sdsu.edu/jsb_lecture18jan05.pdf

[7] Jean M. Twenge, Generation Me, Free Press, New York, 2006.

[8] Kris Stewart, http://www.stewart.cs.sdsu.edu/cs596-3dprog3/calendar-spr08.html