I. Abstract

Computer games are a serious industry, worth thousands of advanced technology jobs all over the world. An argument can be made that games actually plays a large role in driving PC development, especially graphics and audio devices. In addition to the entertainment aspects of video games, they are now being pressed into service as educational and training tools, the so-called ‘serious games’ initiative. We need to know more about how games work internally and what they can do, as parents, educators, multimedia designers, artists, and programmers.

This 1/2 day tutorial will describe the architecture of a modern video game, showing how the basic components combine to create an interactive multimedia entertainment. A game is actually an interactive real-time simulation with graphical and audio interfaces, a narrative, and a goal. Most sub-disciplines of computer science are represented in the construction of a game, and the degree of sophistication needed to create one is very high. This tutorial proposes to describe the essential components of a video game - the game loop, AI, graphics, audio, and the front end - and how they are implemented and how they relate to each other.

This tutorial does not deal with game design, which is not a technical issue, nor with the creation of artistic assets. The intent is to imbue the attendees with enough information that they could embark on a game development project of their own, or at least begin the technical design and find out what other information they required.

II. Target Audience

The target audience is eclectic: engineers and computer scientists, interested in knowing how to design and construct the complex software of a game; artists and musicians keen to know how their skills can be used in the creation of a highly technical multimedia work; students who are interested in a career in game programming; teachers interested in using game technology for teaching. The audience may be interested in creating their own games, in teaching others to make games, or in using games to teach their particular subject.

The audience should have basic programming skills (first year University), and should have a basic mathematical fluency (high school physics, calculus, geometry). A knowledge of computer graphics and/or audio would be useful. It would be useful also if the audience had played a PC game and a console game in the previous year.
### III. Table of Contents/Syllabus

1. **[30 Minutes]** Basic structure of a video game - Architecture
   - General structure and operation of a game
   - Main loop/real-time loop
   - Passage of time.
   - Programming. Documents

2. **[30 minutes]** Game A.I.
   - Keeping track of game objects
   - Contact and tracking
   - Chasing, evasion, patrolling

3. **[30 minutes]** Graphics
   - Real-time rendering: Introduction
   - DirectX/OpenGL
   - Texture maps, bump maps
   - Pipeline

4. **[30 Minutes]** Audio
   - Audio display
   - Effects and timing
   - Music and mood

5. **[30 minutes]** The Front End
   - PC games - the keyboard
   - Mouse, joystick
   - Other interfaces
   - DirectInput

6. **[30 minutes]** A Game Walkthrough
   A guided tour through a commercial game showing some of the effects discussed. Evidence of flaws in the system or of artifacts of the algorithms will be seen. A question and answer session will accompany this section.

This has been planned for a 3 1/2 hour session, typical of a 1/2 day tutorial. It is based on the CPSC 585 course, and has been supplemented by new material obtained from recent conferences (GDC, CGT, E3).
IV. Speaker Bio

Dr. Jim Parker is an academic, researcher and teacher, and an enthusiastic proponent of computer games in education. Dr. Parker created the first University course in Computer Game Programming in Canada, along with industry partner Radical Entertainment. This course was Computer Science 585, a senior class in games programming requiring that the students create a video game as the major project. The course is the capstone of a specialization in computer games at the University of Calgary.

Originally a researcher in both the areas of digital simulation and pattern recognition/computer vision, Dr. Parker now works in areas related to non-traditional interfaces of games, such as gaze, gesture, and audio.

Dr. Parker has also taught courses in games for teaching and computer animation, and is the author of two books, and of over a dozen research papers and talks related to video game technology. He has been lead designer of educational games, and most recently was a speaker at the Computer Game Technology conference in Toronto, Canada. He also owns a farm where he and his family raise ducks and rabbits.

V. A/V Equipment Requirements

This course will require a computer (I could bring a laptop in a pinch) connected to a video projector with sound amplification. I will bring a GameCube console for demonstration purposes.

VI. Other

I have not taught a tutorial at this conference previously, and would prefer to begin with a 1/2 day session. However, it is clear to me that there is vastly more material that we can cover in a half day, or a full day - my regular class requires a full week of 8 hour days. Like many tutorials, what I offer is a taste, but I hope to give them enough so that they can do something useful with it.

I have planned a second half to this tutorial, should it be of interest. It would be a supplement to the course described above, and could be taught as an independent afternoon half-day. A brief summary is:

Game engines - structure and use (half-life; VirTools)
Networked games - protocols, special requirements.
Introduction to terrain modeling
Characters and character animation - what you absolutely need to know
Combat AI and Driving AI: special cases
Documents and software design for games

I would be interested in expanding the initial half-day tutorial to two half day tutorials that can be taken separately, if that would be of interest. I would plan to bring a colleague from a commercial game developer for the full day session.

I am completely convinced that there will be a large number of people interested in this tutorial based on interest in the course, and on the response to the suggestion that a course of this sort be taught from attendees of other conferences.